Patient Outcomes Research Team

LOW BIRTHWEIGHT IN MINORITY AND HIGH-RISK WOMEN

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Low Birthweight in Minority and High-Risk Women

Patient Outcomes Research Team (PORT)
Final Report

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and
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I. ABSTRACT

Low birthweight newborns are those born weighing less than 2,500 grams, either because they are premature (less than 37 weeks' gestational age) or growth retarded (birthweight less than the 10th percentile for gestational age). Nearly 70 percent of all infant mortality is associated with low birthweight, as are about one-third of all handicapping conditions. Some minority women, and especially African American women, have substantially higher rates of low birthweigh babies than do white women.

The multidisciplinary team of investigators at the University of Alabama at Birmingham and the Albert Einstein College of Medicine conceptualized this PORT to focus on the multiple etiologies of both term and preterm low birthweight. The central premise of the conceptual model being developed by the PORT is that low birthweight births are attributable to a complex interplay among biological, intergenerational, socioeconomic, and behavioral influences. Therefore, successful prevention demands an interdisciplinary, multiple-intervention approach that simultaneously considers the health care delivery system and the social, psychological, and cultural forces that affect the lives of women during their childbearing years.

Significant progress has been made in studying the practices aimed at the prevention of low birthweight and its major sequelae. Since its inception, the Low-Birthweight (LBW) PORT has reviewed a large number of obstetrical practices and other health services' interventions utilizing such research methods as integrative literature review, secondary analysis of large representative data sets, secondary analysis of clinical trial data, and decision-analytic and cost-effectiveness modeling. In addition to these ongoing studies, the LBW PORT implemented two large-scale projects: (1) a national 27-site randomized trial of a dissemination intervention strategy to improve the use of antenatal corticosteroids in preterm delivery, and (2) a randomized trial of the effectiveness of a combined prenatal intervention targeting African American women identified as at risk for delivering low birthweight babies.

Key findings from the LBW PORT's review of secondary data sources include:

- The strong relationship between bacterial vaginosis in pregnancy and preterm delivery, especially in African American women.
- A reduction in preterm delivery in women with bacterial vaginosis treated with oral metronidazole and erythromycin.
- The effectiveness of zinc supplementation for improving birthweight in African American women.
- The relationship of maternal weight to the benefits of zinc and folate supplementation during pregnancy.
- The lack of effectiveness of bed rest for preventing preterm delivery.
- The risks versus the benefits of antenatal testing for fetal well-being and the optimal time during pregnancy in which to initiate such testing.

- The most cost-effective strategies for treating urinary tract infection during pregnancy.
- The most cost-effective strategies for maternal screening and treatment to prevent neonatal group B streptococcal sepsis.
- The usefulness of low-dose aspirin therapy to improve pregnancy outcomes.
- Which maternal risk factors or biochemical markers/tests best predict subsequent preterm birth.
- The effectiveness of antenatal corticosteroids for improving the outcomes of very preterm newborns.
- Variation in the use of corticosteroids and determinants of these variations among perinatal centers.
- Effects of level of neonatal intensive care and NICU patient volume on neonatal mortality.
- Estimates of the cost of neonatal intensive care by gestational age and survival.

The findings from LBW PORT practice investigations and ongoing work in modeling risk factors related to low birthweight continue to inform the professional literature, providing the groundwork for clinical practice recommendations about the effectiveness of screening and treatment strategies. Also, findings from the LBW PORT's dissemination and prenatal intervention trials will inform the literature regarding effectiveness of strategies to influence physician practice behavior, and provide valuable information about more effective ways to deliver services to pregnant, low-income, African American women at risk for delivering low birthweight babies, respectively.

II. EXECUTIVE SUMMARY

Background: The Problem of Low Birthweight

Prematurity and low birthweight are major risk factors for infant mortality. Low birthweight newborns are those born weighing less than 2,500 grams, either because they are premature (less than 37 weeks' gestational age) or growth restricted prior to birth (birthweight less than the 10th percentile for gestational age). Nearly 70 percent of all infant mortality is associated with low birthweight, as are about one-third of all handicapping conditions. Some minority women, and especially African American (black) women, have substantially higher rates of low birthweight babies than do white women.

By the early 1990s, after decades of improvement in overall infant mortality rates in the U.S., this country was still seeing no improvement in the disparity between the rates of infant mortality in African Americans compared to whites. While there was a steady decline in the infant mortality rates for all ethnicities, the rates for African Americans declined more slowly and the gap between black and white infant mortality rates actually widened.

Perhaps even more striking is the fact that even though overall infant mortality is improving and the country is closer than ever before in reaching the Nation's Health Objectives for the Year 2000, the rates of low birthweight have not improved and significant differences between blacks and whites continue to be reported for most cause-specific infant mortality. The difference is especially pronounced for preterm births which make up the majority of low birthweight births.

While this country has not seen any improvement in the incidence of preterm birth and the rates of low birthweight overall, there *has* been a significant improvement in the survival rates for preterm infants. Through advances in neonatal intensive care for very low birthweight infants ($<$1,500 grams at birth) and better obstetrical management of preterm and other high-risk deliveries, the birthweight-specific survival rates in the U.S. are among the best in the world.

However, with improved survival of very low birthweight infants have come the increased health care costs associated with more high-tech neonatal intensive care as well as the lifetime costs related to disability and health problems. Even though preterm birth makes up only 10 percent of the total births in this country, it is associated with 50 percent of the birth-related neurologic handicaps.

Conceptual Approach and Research Objectives

Because of the lack of progress in reducing low birthweight in the United States, the Low Birthweight (LBW) PORT was funded to study the effectiveness of practices aimed at the prevention of low birthweight and its major sequelae in minority and high-risk women.

Goals and Objectives

As stated in the original technical proposal to AHCPR, the LBW PORT's overall goals are: (1) to advance the scientific knowledge base about variations in and effectiveness of obstetrical practices and other interventions aimed at the prevention of low birthweight and its negative sequelae; and (2) to develop effective strategies for disseminating findings to health care practitioners and other components of the health care system, women, their families, their social networks, and the community. African American women and other high-risk populations were identified as being of primary concern because they have higher rates of low birthweight babies and appear to be significantly more vulnerable to the problems associated with low birthweight.

To accomplish these goals, the LBW PORT identified six major objectives for guiding its research:

1. To further explore the determinants of low birthweight and its sequelae.
2. To measure the overall effectiveness of strategies that aim to prevent low birthweight and its sequelae.
3. To identify variations in these practices.
4. To explore the causes of these practice variations.
5. To disseminate research findings and recommendations.
6. To implement a large-scale, targeted dissemination effort and evaluate its impact.

Research Team

The LBW PORT was conceptualized by a multidisciplinary team of investigators and practitioners at the University of Alabama at Birmingham (UAB) and the Albert Einstein College of Medicine (AECOM) to focus on the multiple etiologies of preterm delivery (PTD) and intrauterine growth restriction (IUGR). The central premise guiding this team's approach was that low birthweight births are attributable to a complex interplay among intergenerational, biological, and behavioral influences; and that successful prevention, especially of negative sequelae, demands an interdisciplinary approach that simultaneously considers the health care delivery system and the social, psychological, and cultural forces that affect the lives of women during their childbearing years. This premise required the evaluation of practices that go beyond traditional obstetrics.

Scientific and clinical disciplines represented on the team are:

- General obstetrics and maternal-fetal medicine
- Perinatal epidemiology
- General pediatrics and neonatology
- Developmental psychology
- Anthropology
- Health behavior and behavioral medicine
- Dissemination and evaluation research
- Health economics and health services research
- Biostatistics

Members of the LBW PORT investigative team, collaborating institutions and investigators, and the members of the National Advisory Panel are listed in Appendix A of this Final Report.

Methodologies

To evaluate such a diverse and large number of obstetric and other health systems' practices and to further explore the determinants of low birthweight, the LBW PORT used the following research methodologies:

- Literature review and synthesis to determine the existing evidence for efficacy and effectiveness.
- Secondary analysis of large clinical and population-based data sets to explore practice variation, risk factors, and outcomes.
- Qualitative research utilizing focus group and key informant interview techniques to

examine physician opinion and perception of practice.

- Secondary analysis of physician survey data to explore physician perceptions about practices and variation in opinion.
- Decision-analytic and cost-effectiveness modeling techniques to determine best evidence practices for various screening and treatment strategies.
- Randomized controlled intervention trials.
- Multi-level statistical modeling to evaluate the impact of a large-scale dissemination study.

Major Accomplishments

The LBW PORT reviewed a large number of strategies aimed at the prevention of low birthweight and its sequelae (i.e., the associated morbidity and mortality). This PORT purposely flung a wide net in an attempt to sort out and determine which strategies were and were not effective.

In addition to reviewing practices per se, the LBW PORT invested significant time in exploring the data sets available to the investigators in order to better understand the determinants of low birthweight, especially in African American women.

These ongoing practice reviews and secondary data analyses have resulted in a large number of publications and practice recommendations that have been disseminated through the major peer-reviewed journals and at various professional meetings across the country. Target audiences have included obstetricians, pediatricians, clinician researchers, public health professionals, health services researchers, and other disciplines involved in practice, clinical policy, and research related to the care and/or outcomes of pregnant women at risk of delivering preterm/low birthweight babies. Table 1 illustrates the productivity of the LBW PORT and its program of research.

Table 1
Ongoing Dissemination Activities and Contributions:
LBW PORT Findings in the Literature

- Publication of over 100 peer-reviewed scientific articles and reviews (including *NEJM*, *JAMA*, *Nature Medicine*, *AJOG*, *Ob/Gyn*, *Pediatrics*, *J Pediatrics*, *A J Public Health*, *JAMWA*)
- 4 prominent editorials
- 95 published research abstracts
- 11 book chapters and symposia

The PORT also invested considerable resources in the implementation of two large studies: (1) the Antenatal Corticosteroid Dissemination Study, a national 27-site randomized trial of a dissemination intervention strategy to improve the use of corticosteroids in preterm delivery; and (2) the Prenatal Intervention Trial (Mother and Family Specialty Center), a randomized trial of a combined prenatal intervention program targeting low-income African American women identified as high risk for delivering low birthweight babies. These two major efforts have resulted in an increased understanding of the conditions and strategies necessary to influence physician practice behavior, and provided valuable information about the role of prenatal care in affecting the outcomes of low-income, high-risk pregnant women, respectively.

As demonstrated in the following section on summary findings and implications, many of the LBW PORT's original contributions and collaborations have influenced clinical practice recommendations at the national level.

Summary Findings and Implications

The LBW PORT focused many of its resources on trying to better understand why we have not been successful in reducing the rate of preterm birth and have had only limited success in reducing the rate of fetal growth restriction.

With respect to preterm birth, there are essentially two major categories of strategies that can be addressed: (1) strategies aimed at prevention or delay of preterm birth, and (2) treatments focused on the reduction of prematurity-associated morbidity and mortality. With respect to fetal growth restriction, the interventions are more related to prevention of the maternal risk factors and behaviors that are associated with poor pregnancy outcomes.

General Conclusions Regarding the Effectiveness of Various Strategies

Most interventions aimed at reducing low birthweight have not been shown to be consistently effective in prospective randomized clinical trials or even in various types of retrospective studies.[40,109] However, there have been some major advances in the field of obstetrical research that show promise for developing more effective interventions. There are also specific strategies that are targeted at improving the short- and long-term outcomes of preterm babies that have been proven effective.

Corticosteroids for Improving Infant Outcomes in Preterm Delivery

By administering certain corticosteroids to pregnant women within a number of hours prior to preterm delivery, their babies immature organ systems are given a "boost," protecting these preterm infants from severe disability and death. This therapy has been proven highly effective, is inexpensive and, until recently, was very underutilized. Through the LBW PORT's original research contributions and our involvement in an NIH Consensus Development Conference, "Effectiveness of Antenatal Corticosteroids for Fetal Maturation on Perinatal Outcomes, February 28-March 2, 1994," national recommendations were crafted and disseminated to specifically address the concerns providers expressed about the use of this therapy in clinical practice. Also, a national 27-site randomized controlled trial of an "active" dissemination effort was undertaken by the LBW PORT to improve the impact of the release of these recommendations.

PORT findings that influenced the Consensus Panel

- Corticosteroid therapy administered to the mother prior to birth is effective in reducing respiratory distress syndrome, intracranial hemorrhage, and mortality in the premature newborn.[77] The LBW PORT analyzed data on the outcomes of very preterm infants that helped define the gestational ages when corticosteroid use was most effective in protecting against these poor outcomes.

These findings helped to influence the Consensus Panel's recommendations to administer steroids to women at risk of very early preterm delivery (24-28 weeks' gestation).

- Another LBW PORT analysis further demonstrated the protective effects of antenatal corticosteroids when given alone or in combination with drugs to inhibit preterm labor. It also confirmed previous findings that labor-inhibiting therapy without the protective effects of corticosteroids may be harmful in very preterm deliveries.[6] These findings influenced the recommendation that obstetricians should not hesitate to administer this therapy to all women at risk for delivering very preterm (between 24 and 28 weeks' gestation), especially if they are considered eligible for labor-inhibiting drug therapy.
- The LBW PORT conducted exploratory qualitative research on physicians' (obstetricians and neonatologists) opinions about antenatal corticosteroid therapy to determine why this highly effective intervention was only rarely used. Reasons for the underutilization included: physician confusion about the risks versus benefits of this therapy, uncertainty about the timing of administration with respect to effectiveness, waiting to see if use of tocolytics (labor-inhibiting drugs) would stop or slow the progression of labor before administering steroids, and confusion about the effectiveness of the therapy in different populations and under various clinical conditions.[74] This research was conducted shortly before the NIH Consensus Conference took place, and the findings, which were presented to the NIH Consensus Panel, influenced the crafting of Consensus Statement recommendations so that they would more clearly address obstetricians' concerns, uncertainty, and confusion.
- The PORT conducted an exploratory secondary data analysis of eight large multicenter clinical data sets to better understand the determinants and level of practice variation in the use of corticosteroids prior to the NIH Consensus Conference. Five of the data sets were obtained through the LBW PORT's involvement with the Consensus Conference; the other three were available to

the investigators' involvement in multicenter trials prior to the PORT. These preliminary findings, along with our qualitative research findings, were used to inform the design of the LBW PORT's dissemination effort. The findings also supported the observations from the NIH-commissioned outcome reviews regarding the variation in rates of use across centers and networks and patterns of use with respect to gestational age at birth, maternal race, type of institution, and amount of prenatal care received by the mother.[13]

- A later, more-detailed analysis of one of the larger of these eight multicenter data sets employed regression techniques to model the determinants of practice variation in the use of this therapy. This analysis found that when clinical conditions and site of care were controlled for with these modeling techniques, the variation in use of corticosteroids was more associated with maternal characteristics such as race/ethnicity than were other more widely accepted high-risk pregnancy interventions, specifically the use of tocolytics. The finding that corticosteroids were used less frequently when tocolytics were used supported the PORT's earlier findings from our qualitative research (i.e., that physicians often wait to see if they can stop preterm labor before considering corticosteroid therapy). This timing issue was thought to be a major barrier to the effective use of corticosteroids in preterm delivery and formed the basis of the LBW PORT's dissemination emphasis on the NIH recommendation that women who were determined eligible for tocolytic therapy at less than 34 weeks' gestation should also receive corticosteroid therapy, unless otherwise contraindicated.[14]

Through these contributions, the LBW PORT worked with the NIH to define the appropriate use of corticosteroids and to address these concerns when crafting the Consensus Statement and recommendations.

Results of the Corticosteroid Dissemination Effort

In conjunction and collaboration with the release of the NIH recommendations, the LBW PORT undertook an "active," national 27-site randomized controlled trial of a multi-pronged dissemination strategy targeting the physicians most likely to care for pregnant women at risk of delivering preterm babies. LBW PORT investigators also helped NIH evaluate pre-post survey data on the effectiveness of the Consensus Conference in changing obstetricians' opinions and self-reported practice regarding use of antenatal corticosteroids.

Key findings from the dissemination effort are:

- Even before the NIH Consensus Conference, the use of corticosteroids in preterm delivery has increased dramatically in many perinatal centers across the country (from approximately 30 percent of women who delivered prematurely prior to 1994 to almost 70 percent by 1996). However, the LBW PORT's Antenatal Corticosteroid Dissemination Study increased the use of this inexpensive and highly effective intervention over and above the NIH Consensus Conference impact.[125]
- Obstetricians' opinions and practices (as measured by both clinically documented and self-reported practice behavior) regarding the appropriate conditions for the use of therapy have changed in association with the NIH recommendations for use.[125]

Under the right conditions, the LBW PORT has demonstrated that a low-cost "active" dissemination strategy can significantly improve the response to the dissemination of national practice recommendations. These findings suggest that targeted active dissemination efforts can improve the adoption of national practice recommendations when they involve knowledge of the reasons for barriers to change.

As a result of the LBW PORT's efforts, the benefits of improving the use of corticosteroids to improve preterm birth outcomes have attracted the attention of managed care and State-level quality improvement initiatives. Components of the LBW PORT's dissemination strategy were modeled by United HealthCare, a large national managed care organization, which conducted a pilot project to evaluate and improve the use of antenatal corticosteroids among its obstetrician provider networks across the country. The LBW PORT was also recently consulted by the New York State District of the American College of Obstetricians and Gynecologists regarding an intervention study aimed at improving the use of corticosteroids at hospitals in New

York State. Members of the AECOM dissemination team are consulting on this project, and the PORT has provided educational materials.

Long-Term Outcomes of Low Birthweight Babies Associated With Maternal Risk Factors for Prematurity and Fetal Growth Restriction

The LBW PORT has worked extensively with a series of analytic data sets constructed from a longitudinal study of small-for-gestational-age (SGA) and preterm births to further explore the determinants of fetal growth restriction (or SGA births and preterm births). This study includes data on pregnancy-related and maternal risk factors, outcomes data at birth, and followup outcomes data on SGA and preterm infants with respect to growth and development at 1 and 5 years of age. Findings from six analyses using the data on various maternal factors and characteristics linked to birth outcomes, and using the 1-year followup data, were recently featured in a supplement of *Acta Obstetricia et Gynecologica Scandinavica.* [36, 53, 54, 81, 83, 103]

Also, the LBW PORT has already begun working with the 5-year followup data and recently published initial findings on the relationship of being small for gestational age or preterm on intelligence at age 5 in a subset of 546 African American children. The SGA data set was also used by the LBW PORT investigators to determine whether various sociodemographic, environmental, and maternal characteristics or risk factors explain the difference in low birthweight-related pregnancy outcomes between black and white women. Findings from these analyses have resulted in a better understanding of the relationship between maternal characteristics, pregnancy outcomes, and fetal or infant growth and development.

Major findings from these various secondary data analyses include:

- In a low-income population of black and white women, many of the medical, psychosocial, and behavioral risk factors traditionally associated with higher rates of low birthweight in black women were actually more common among white women; however, black women still had more infants born preterm with growth restriction and with low birthweight. This finding indicates that these traditional risk factors do not explain the differences in rates of low birthweight between black and white women. Other, more powerful risk factors must be searched out.[47]

- The LBW PORT's first preliminary analysis using the 5-year followup data found a small but significant decrease in IQ for both groups of high-risk children, and an increased risk of mental retardation for the SGA group. The analysis also found that higher maternal language skills, positive home environment, and preschool attendance were associated with an improved mean IQ.[49]

The PORT will continue to explore this data set with other investigators to further evaluate the long-term developmental outcomes associated with being born preterm or growth restricted. Plans are underway to ask for funding to continue this work.

Maternal Weight, Nutrition-Related Interventions, and Nutrient Supplementation

The LBW PORT has published a large body of work in these related areas.[43,44,63,64,65,66,67,68,69,80,81,82,100,103] Conceptually, there are four areas of nutrition-related impact on low birthweight. The PORT explored these areas using various secondary data sets to better understand these relationships. The major findings from this body of work are:

- Poor pregnancy weight gain and low prepregnancy weight are associated with both preterm birth and fetal growth restriction.
- Counseling women about diet does not appear to improve pregnancy outcome.
- Supplementing women with high protein diets has a negative impact on pregnancy outcome.
- In western countries, caloric supplementation has little, if any, impact on preterm birth.
- Zinc and folic acid supplementation are associated with increased birthweight and may reduce preterm birth. However, maternal weight appears to have an impact on the effectiveness of these nutrient supplements (i.e., thin women with low plasma levels of zinc benefit more from supplementation).

In summary, the relationship of caloric and nutrient supplementation is complex, but women with adequate nutrition and who are of normal weight have better pregnancy outcomes. Also, the findings on zinc and folic acid supplementation confirm the value of the use of zinc as part of the daily vitamin and mineral supplement in pregnancy. Zinc and folic acid supplementation is now recommended for all pregnant women. However, the effects of nutritional interventions on preterm birth remain unclear.

Infection and Preterm Birth

Sexually transmitted diseases during pregnancy, infection of the lower (vagina and cervix) and upper female reproductive tract (amniotic fluid and chorioamnion), and a specific condition called bacterial vaginosis are strongly associated with spontaneous preterm birth and other adverse pregnancy outcomes. In particular, the LBW PORT has invested considerable effort in confirming this association and its role in preterm birth in African American women.[2, 45,46, 51,60,61]

- The LBW PORT (along with other findings) has confirmed a strong relationship between vaginal infection and preterm birth. The LBW PORT's work has also more clearly defined the role of upper and lower genital tract infection in spontaneous preterm birth than have previous studies. Findings suggest that as many as 80 percent of early preterm births are associated with intrauterine infection.[2,46]
- In collaboration with investigators on the NICHD's Vaginal Infections and Prematurity (VIP) Study, the LBW PORT evaluated a subset of the VIP data set which consists of infection-related data on 13,747 predominately low-income pregnant women. This analysis demonstrated that vaginal infection is more closely related to preterm birth in black than in white women, accounting for 40 percent of the excess preterm birth in black women.[45]
- Based on a study supported by the LBW PORT and the March of Dimes, we demonstrated that antibiotic treatment of bacterial vaginal infection reduced preterm birth. Findings from this study provide evidence that women with bacterial vaginosis are at high risk for preterm birth and that treating these women with the right combination of antibiotics may provide an effective means of preventing preterm birth. [60]

As a result of the LBW PORT and other findings, it is now being recommended that women with vaginal infections be aggressively screened and treated with the right combination of antibiotic therapy for these infections. This new management strategy is likely to have a significant impact on reducing the rate of very low birthweight in African American women. These and other findings have also been instrumental in convincing NIH to fund a large-scale research trial on a screening test (or marker) for bacterial vaginosis.

Biochemical Predictors of Preterm Birth

There is a growing body of literature on the various biochemical and biophysical characteristics of the vagina and their association with spontaneous preterm birth. Elevations of certain biochemical substances, produced as part of the inflammatory process resulting from infection, have been associated with preterm birth. These include C-reactive protein, abnormal organic acids (pH), prostaglandins, bacterial products, and proinflammatory cytokines. There are also other potential markers of infection related to preterm delivery found in the blood serum of pregnant women, such as elevated plasma alkaline phosphatase, ferritin, and certain hormones. LBW PORT investigators, both in parallel and in collaboration with colleagues in NIH-funded studies, have been involved in examining several of these biochemical markers or predictors. Findings from these studies include:

- The presence of interleukin-6 (IL-6) in the amniotic fluid is associated with an increase in spontaneous labor and may be useful as a predictor (or marker) for upper genital tract infection, leading to early spontaneous preterm labor and premature preterm rupture of membranes. [2, 107, 119, 120]
- Through access to data from the serum samples of women in previous studies on risk factors for preterm delivery or term low birthweight, the LBW PORT has been able to look at the relationship of various substances in the maternal blood to preterm birth. These evaluations suggest that if measured at the right time during pregnancy, these serum substances may be useful predictors of spontaneous preterm birth. [48,52,56,101]

These findings, in addition to the findings on the use of fetal fibronectin as a marker for spontaneous preterm birth, suggest that progress in developing these markers may help identify women at risk who should be targeted for preventative therapy such as prophylactic antibiotics. However, before effective preventative therapies can be recommended or tested, a better understanding is needed of the biochemical events related to infection (including the role of other factors). [2,46,56]

Low-Dose Aspirin Therapy, Preeclampsia, and Pregnancy Outcomes

Preeclampsia (a worsening of pregnancy-induced hypertension) is one of the major reasons for indicated preterm delivery. The diagnosis of this condition usually indicates that the mother or the fetus is at unacceptable risk should the pregnancy continue. Research has shown that the pathway leading to preeclampsia involves an over-production of a biochemical substance called serum thromboxane. Aspirin has been used to inhibit the production of this chemical in the body, and early clinical trials suggested that aspirin therapy was effective in reducing the risk of preeclampsia. However, aspirin therapy had also shown an association with an increased risk of placental abruption, a very dangerous condition for the mother and baby. To examine the benefits versus risks of low-dose aspirin therapy further, the LBW PORT performed a secondary analysis of clinical trial data to examine how maintained reduction in serum thromboxane affected pregnancy outcomes in addition to preeclampsia. We also conducted a meta-analysis of data from 10 clinical trial results to determine the association of low-dose aspirin therapy with subsequent placental abruption or perinatal mortality. Findings from these analyses are:

- In a secondary analysis of data from a clinical trial of the effects of low-dose aspirin therapy on preeclampsia, the LBW PORT found an association with aspirin therapy compliance as measured by a maintained decrease in serum thromboxane levels and improved outcomes such as less preeclampsia, less premature rupture of membranes, fewer preterm births, higher mean birthweight, and fewer SGA births. [59]
- Because of a concern about the risk of placental abruption and subsequent perinatal mortality in women who undergo daily low-dose aspirin therapy for the reduction of preeclampsia, LBW PORT investigators conducted a meta-analysis of data from 10 clinical trials on low-dose aspirin therapy for preeclampsia or fetal growth restriction to determine the effectiveness versus the risks of this

therapy in certain populations. This analysis did not find any association with risk of placental abruption of perinatal mortality and receiving preventive low-dose aspirin therapy (suggesting that the benefits of therapy outweigh the risks). [58]

Effectiveness of Various Antenatal Screening and Treatment Strategies

Clinician researchers on the LBW PORT have focused on the usefulness of decision-analytic modeling techniques for the cost effectiveness or cost-benefit evaluation of various screening and treatment techniques used by obstetricians during pregnancy. [90,91,92,93,94,96,114,117] A major contribution from this work is the analysis of obstetrical screening and treatment strategies aimed at the prevention of neonatal group B streptococcal infection, a serious and often fatal disease of newborns.

Screening and Treatment of Group B Streptococcal Infection

- Infants exposed to group B streptococcal (GBS) bacteria via infection in the mother prior to birth can suffer serious consequences, even death. The PORT undertook a decision analysis that reviewed 19 different obstetric screening and treatment strategies for cost-effectiveness in dealing with this life-threatening condition (including two competing recommendations by the American College of Obstetricians and Gynecologists and the American Academy of Pediatrics). Three screening and treatment strategies were determined to be optimal (i.e., more effective and less expensive), given the present state of knowledge. [89]
- According to the cost estimates and probabilities of GBS infection used in the PORT's decision analysis, the adoption of these three optimal strategies would reduce the direct costs of this disease by approximately one-half to one-third the cost of no obstetric treatment. [89]

These findings have lead to specific screening and treatment recommendations by the Centers for Disease Control (CDC) for the clinical management of GBS infection. The CDC used the PORT's findings in their published guidelines which were widely disseminated to physicians that care for pregnant women and newborns.

In addition, other LBW PORT cost-benefit analyses evaluated the additional impact of these nationally recommended obstetric GBS screening and treatment strategies on the cost of the pediatric care response to the management of early onset neonatal GBS infection. These studies found that while these obstetric management strategies would increase the pediatric costs related to additional hospitalization and testing for some babies, the recommended obstetric strategies were still cost beneficial. [24, 85, 124]

Comprehensive Prenatal Care

To supplement the literature regarding the lack of evidence for effectiveness of these strategies for the prevention of preterm birth, the LBW PORT also conducted a randomized controlled trial of the effectiveness of a comprehensive, best practices, prenatal intervention program for low-income (Medicaid-eligible) African American women. The women targeted for this study had multiple risk factors for low birthweight births.

- Although compliance, satisfaction with care, and knowledge of risk factors were increased among the treatment group, the risk-factor-targeted intervention package did not have a significant impact on the rate of low birthweight, preterm birth, or intrauterine growth restriction in the study population.

Findings from this study indicate more clearly than ever before that prenatal care by itself, even when it is of high quality and provided in a culturally supportive and targeted manner, *will not* be a major factor in reducing rates of low birthweight among children born to low-income African American women.

However, the findings also support the value of prenatal care for helping low-income minority women become more knowledgeable about their pregnancies and risk factors and can contribute to positive maternal behavior change such as smoking cessation during pregnancy.

Neonatal Intensive Care: The Impact of Managed Care on Regionalization and Infant Mortality

The LBW PORT, in collaboration with the Rand Child Birth Management PORT, supported the construct of an analytic data set that linked California infant birth and death certificate data with infant discharge abstracts for 473,209 infants born in 1990. This data was analyzed as a collaborative effort between PORT investigators and investigators at Stanford University, Palo Alto Institute of Research and Education, and UC San Francisco to study the impact of perinatal center volume and level of care on neonatal mortality in California in 1991.

During the early 1990s in California, there was a trend toward the deregionalization of high-risk perinatal care.

- Findings from this analysis confirm delivery in a facility with a level III designation neonatal intensive care unit (NICU) is associated with lower risk-adjusted neonatal mortality. Likewise, the findings suggest that the trend in increased competitive contracting and the managed care environment in California in the 1990s had a negative impact on the State's infant mortality rates. This trend was accompanied by a major growth in intermediate level II and II+ neonatal intensive care facilities in the State. [87,126]

The findings from this analysis are of concern. One of the most significant achievements in the past two decades in the reduction of infant mortality is due to perinatal care regionalization for high-risk deliveries and the resulting improvement in technologies for the management of preterm delivery and premature infants. Further work on this data set with respect to building in linked data for consecutive and more recent years will provide important information regarding the impact of managed care with respect to regionalized perinatal care and neonatal outcomes.

Specific Interventions Not Found Effective in Reducing Preterm Birth

Most interventions reviewed by the LBW PORT that were aimed at the reduction of preterm birth were not shown to be consistently effective in prospective randomized trials or even in various types of retrospective studies. [4,6,26,39,40,46,47,54,101,109] Much of the work in this area involved review and synthesis of the literature and the use of secondary data analysis to augment the data available in the literature. The LBW PORT spent its first year sorting through the literature on many of the practices of interest to the scope of work and determined that the evidence for effectiveness was not definitive. In most of the practices that were reviewed, it was apparent that further exploration of the associations between these practices, risk factors for low birthweight, and outcome was necessary. Following are some of the specific practices determined to be ineffective for the prevention of premature birth:

- Bed rest
- Risk scoring systems
- Iron supplementation

- Most labor inhibiting drugs/agents
- Drug, alcohol, and tobacco cessation programs
- IV hydration for premature labor
- Home uterine activity monitoring

We believe that wide dissemination of information on which practices *do not work* to prevent preterm birth (such as bed rest for treatment of preterm labor) has decreased the use of expensive and at times potentially harmful practices and allowed resources to be better utilized.

Other Research Activities and Findings

It is not possible to summarize all the activities conducted under the LBW PORT program of research in an Executive Summary. Therefore, we have developed an Annotated Table of LBW PORT Research Activities which is provided as Appendix B. This table of research activities includes a description of the study area, research methods and/or data sets employed, and a link to the LBW PORT's Cumulative Bibliography, so that any resulting publications may be consulted for findings and recommendations. The LBW PORT Cumulative Bibliography is organized by first author, then chronologically by date of publication. We have organized the bibliography in this way to better represent the body of work contributed by investigators. The complete Cumulative Bibliography, including abstracts, presentations, and non-peer-reviewed publications, is attached as Appendix C.

Summing Up

The LBW PORT has made significant progress in studying the practices aimed at the prevention of low birthweight and its major sequelae. The findings from PORT practice investigations have informed the professional literature and provided the groundwork for recommendations regarding practices that remain in question as to their benefits and/or risks. Unfortunately, despite the utilization of ever-increasing amounts of research and clinical care resources aimed at achieving prevention or reduction, there is very little evidence to date that any intervention or practice has had a major impact. Neither the medical/obstetrical strategies nor behavioral approaches (smoking or drug cessation programs, nutritional counseling or supplementation, provision of culturally appropriate and supportive prenatal care, etc.) in practice today have had a significant impact on the rate of preterm birth.[40,109]

However, we are optimistic that what has been learned over the past 5½ years by the LBW PORT and others in the areas of infection and preterm birth will move the field forward with respect to better targeted interventions for reducing the rate of prematurity and low birthweight and its major sequelae.[2,56,61,109]

Research priorities need to be concentrated in the continued search for factors that explain the specific causes (etiologies) of spontaneous preterm birth, such as infection in the lower and upper reproductive tract, and also in the continued funding of carefully designed trials of new practices that have strong theoretical potential to reduce the rate of low birthweight and prematurity. Of equal importance are studies that aim to more effectively or extensively utilize practices that have been proven effective, such as improving the use of antenatal corticosteroids in preterm delivery, and disseminating recommendations regarding the most effective screening and treatment strategies for maternal group B streptococcal infection.

In addition, until we have more effective strategies to prevent both preterm and term low birthweight, it is critical that we continue to ensure that those low birthweight infants who are born survive free of major long-term disability to the greatest degree possible. This includes assuring that premature newborns are born in perinatal centers with level III designated NICUs. It also includes gaining a better understanding about how low birthweight infants do as they grow and develop. To date, most evidence suggests that very low birthweight infants are more at risk for long-term neurological and developmental problems; therefore, using longitudinal databases that include maternal and pregnancy-related characteristics linked to infant outcomes and child development measures will allow us to better understand the determinants of these poorer long-term outcomes (and will also help in the effort to develop better early intervention programs after birth). Through the work of the LBW PORT, investigators plan to continue preliminary work in this area.

Much of the PORT's research has stimulated additional research and posed further questions about the causes of prematurity and low birthweight. The practice evaluations and secondary data analyses conducted under the PORT's program of research have reaffirmed many of the investigators original hypotheses about the lack of effectiveness of most interventions used in practice today with respect to the prevention of low birthweight, further convincing us that there is a need for better understanding of the determinants of preterm birth in all ethnicities, but especially in African American women.

To this end, the Principal Investigator and others will continue the course of research developed during this PORT in the areas of infection and preterm, the development of better makers/predictors of preterm birth, and the development of more targeted, and therefore more effective, interventions based on our improved understanding of the various risk factors for low birthweight and causes of preterm birth.

III. FINAL REPORT

A. Overview of Project Goals and Methods

As stated in the original technical proposal to AHCPR, the LBW PORT's overall goals are: (1) to advance the scientific knowledge base about variations in and effectiveness of obstetrical practices and other interventions aimed at the prevention of low birthweight and its negative sequelae; and (2) to develop effective strategies for disseminating findings to health care practitioners and other components of the health care system, women, their families, their social networks, and the community. African American women and other high-risk populations were identified as being of primary concern because they have higher rates of low birthweight babies and appear to be significantly more vulnerable to the problems associated with low birthweight.

Research Objectives

To accomplish these goals, the LBW PORT identified six major objectives for guiding its research:

1. To further explore the determinants of low birthweight and its sequelae.
2. To measure the overall effectiveness of strategies that aim to prevent low birthweight and its sequelae as well as their effectiveness in different subgroups.
3. To identify variations in these practices when possible.
4. To explore the causes of these practice variations through the use of secondary data sets.
5. To disseminate research findings and recommendations to practitioners and other key groups in the health care community (e.g., policymakers and the general public [where appropriate]).
6. To implement a large-scale, targeted dissemination effort and evaluate its impact.

These objectives formed the basis for the research strategy as presented in the following diagram from the Technical Proposal (see Figure 1).

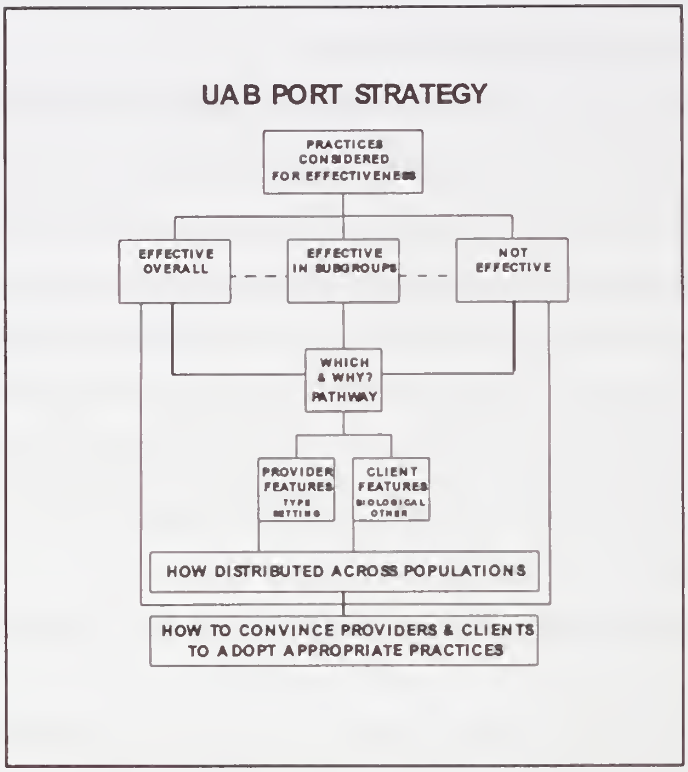

UAB PORT STRATEGY
PRACTICES CONSIDERED FOR EFFECTIVENESS
EFFECTIVE OVERALL
EFFECTIVE IN SUBGROUPS
NOT EFFECTIVE
WHICH & WHY? PATHWAY
PROVIDER FEATURES TYPE SETTING
CLIENT FEATURES BIOLOGICAL OTHER
HOW DISTRIBUTED ACROSS POPULATIONS
HOW TO CONVINCE PROVIDERS & CLIENTS TO ADOPT APPROPRIATE PRACTICES

Figure 1

Conceptual Approach

From the beginning, the multidisciplinary team of investigators and practitioners at the University of Alabama at Birmingham (UAB) and the Albert Einstein College of Medicine (AECOM) conceptualized this PORT to focus on the multiple etiologies of preterm delivery (PTD) and intrauterine growth retardation (IUGR). The central premise was that low birthweight births are attributable to a complex interplay among intergenerational, biological, and behavioral influences and that successful prevention of low birthweight and its negative sequelae demands an interdisciplinary approach that simultaneously considers the health care delivery system and the social, psychological, and cultural forces that affect the lives of women during their childbearing years.

The team proposed to look at the relationship of diverse obstetrical practices to pregnancy outcomes, including the long-term sequelae of low birthweight, especially very low birthweight. This focus included the evaluation of practices that exceed the purview of traditional obstetrics such as individual and systems-level factors affecting health care utilization and differential pregnancy outcomes, especially for minority and underserved populations.

Research Team

The LBW PORT research team was organized by the Executive Committee, which consisted of the Principal Investigator and the chairs of the two technical cores that were structured to focus on data analysis and dissemination issues. The Executive Committee and other lead investigators involved in the original conceptualization of the PORT made up the internal Steering Committee. In addition to the internal team of experts involved, the PORT assembled a National Advisory Panel to help guide the research and provide expert consultation and knowledge resources. The National Advisory Panel was diverse enough to represent the various disciplines and research interests of the LBW PORT's multi-disciplinary team.

Scientific and clinical disciplines represented on the team were:

- General obstetrics and maternal-fetal medicine.
- Perinatal epidemiology.
- General pediatrics and neonatology.
- Developmental psychology.
- Anthropology.
- Health behavior and behavioral medicine.
- Dissemination and evaluation research.
- Health economics and health services research.
- Biostatistics.

Members of the LBW PORT investigative team, collaborating institutions and investigators, and the members of the National Advisory Panel are listed in Appendix A.

Methodologies

To evaluate such a large and diverse number of obstetric and other health systems' practices and to further explore the determinants of low birthweight, the LBW PORT utilized the following research methodologies:

- Literature review and synthesis to determine the existing evidence for efficacy.
- Secondary analysis of large clinical and population-based data sets to explore practice variation, risk factors, and outcomes.

- Qualitative research utilizing focus group and key informant interview techniques to examine physician opinion and perception of practice.
- Secondary analysis of physician survey data to explore physician perception about practices and variation in opinion.
- Decision-analytic and cost-effectiveness modeling techniques to determine best evidence practices for various screening and treatment strategies.
- Randomized controlled intervention trials.
- Multi-level statistical modeling to evaluate the impact of a large-scale dissemination study.

To begin addressing the research objectives, the LBW PORT organized the research team into study panels (resource panels) charged with focusing on practices considered to fall into four major areas: (1) Medical/Obstetrical Practices, (2) Behavioral Risk Factors and Interventions, (3) Provider/Health Systems-Level Influences, and (4) Pediatric/Developmental Outcomes and Interventions. The practices studied are listed in Table 1. Also, as an overarching consideration, the panels were challenged to address the influence of biological, contextual, and sociocutural issues associated with minority women's responses to pregnancy-related interventions whenever relevant or possible. Each study panel was chaired by a member of the PORT's Steering Committee, all of whom were involved in conceptualizing the LBW PORT proposal, and they are all considered experts in their respective fields.

Table 1: PORT Studies
by Influences on Preterm Birth and Intrauterine Growth Retardation (IUGR)

Behavioral Interventions **Variation/effectiveness, relationship to outcomes**	**Behavioral Influences** **Epidemiology of preterm birth & IUGR, relationship to outcomes**	**Medical/Obstetric Practices** **Practice effectiveness/ variation, relationship to outcomes**	**Provider/Health Systems** **Relationship to outcomes**
■ Substance abuse treatment and prenatal care ■ Nutritional support, counseling, & prenatal weight gain ■ Family planning ■ Preconception care ■ Smoking cessation	■ Stress (work related, psychosocial) ■ Substance abuse (alcohol, cocaine, opiates) ■ Prepregnancy weight ■ Wantedness & risk behaviors ■ Interpregnancy intervals ■ Relationship of substance abuse to STDs and other risky behaviors ■ Smoking during pregnancy ■ Black/white differences ■ Previous preterm birth (PTB)	■ Bedrest ■ Low-dose aspirin ■ Antenatal fetal testing ■ Antenatal screening & treatment strategies ■ Iron supplementation ■ Zinc & folate supplementation ■ $MgSO_4$ therapy ■ Corticosteroid therapy ■ IV hydration ■ Asthma treatment ■ Predicting timing of delivery ■ Methods to postpone preterm delivery ■ Infection & PTB ■ Biochemical markers for PTB ■ Surfactant & neonatal outcomes	■ Selection bias in use of prenatal care ■ Ethnicity & source of prenatal care ■ Provider perception & knowledge ■ Perinatal center volume & effect on neonatal mortality ■ Cost by survival & GA model ■ The role of maternal characteristics/access to neonatal intensive care ■ Cost of care estimates for newborns exposed to cocaine ■ Early intervention ■ Practice variation in use of high-risk OB interventions

Prioritizing Practice Reviews and Analyses

In the Technical Proposal, the LBW PORT identified an extensive list of practices that would be considered for evaluation for effectiveness in reducing the rates of IUGR, prematurity, and associated sequelae. Hypotheses were presented for each of the practices or groups of practices.

Because of the magnitude of effort required to address every practice and intervention listed in the LBW PORT's Technical Proposal, the Steering Committee constructed a set of questions which would guide each panel's prioritizing process. This process was presented to AHCPR and subsequently presented to the LBW PORT's Advisory Panel.

In general, this process incorporated the following questions:

1) Has there been a sufficient presentation or synthesis of the evidence in the literature?
2) If so, is the best evidence sufficient to answer questions about effectiveness overall and then in minority populations?
3) Is there a sufficient synthesis? If not, try to determine if there is sufficient quality of data presented in the literature and determine the best method for using this data to better determine evidence of effectiveness. Can a meta-analysis or integrated literature review be performed?
4) If not, is there a data set available to supplement the literature for secondary analysis?
5) If effectiveness is suggested, does practice variation need to be studied?
6) Is the evidence on efficacy or effectiveness and practice variation strong enough? Is a decision-analysis appropriate?
7) Do the findings regarding effectiveness of or variation in a practice need to be disseminated? Are they strong enough?

This LBW PORT's internal prioritzing process included presenting findings to the LBW PORT's Steering Committee, Advisory Panel, and AHCPR on the practices that had been selected as important for either dissemination or further study by this PORT.

The original conceptualization of this PORT built heavily on the earlier work and contributions of the principal investigators and colleagues, many of whom participated on the National Advisory Panel. Prior to the PORT's beginning in late 1992, much groundwork had been laid by the principal investigators and advisor panel members involved. Also, the PORT had the advantage of preceding contributions made by Michael S. Krammer's work on synthesizing the literature and data on the determinants of low birthweight (Krammer, 1987).

In addition to this advantage, the field of obstetrics has access to a massive literature synthesis conducted by Ian Chalmers and colleagues (Oxford, England) on randomized trials for a large number of practices published in a two-volume book entitled *Effective Care in Pregnancy and Childbirth*. Also, this synthesis is periodically updated via a database of perinatal trials and evidence. Although this literature synthesis and database is an enormous resource, it deals almost exclusively with data from randomized trials and does not address the issues of effectiveness of practices as applied to certain populations (by different types of providers and in different care settings). It also does not attempt to review the determinants of low birthweight in different ethnic groups of women.

Although the Oxford Pregnancy and Childbirth Database was initially consulted as a starting point, there was, more often than not, a need to review other literature and conduct secondary data analyses to model questions pertaining to effectiveness or associations and risk factors related to low birthweight in various populations.

While there are certainly pitfalls inherent in casting such a wide net as did this PORT, we believe that the body of work produced by the team (including the recommendations for a targeted dissemination around corticosteroids for preterm delivery, as well as other recommendations) shows that our process was highly productive.

B. Findings and Accomplishments

The following sections of the *Final Report* describe the LBW PORT's primary findings regarding the Antenatal Corticosteroid Dissemination Study, the Prenatal Intervention Trial (Mother and Family Specialty Center), and summarize the many ongoing PORT research and dissemination activities with respect to secondary data analyses, decision-analytic modeling, and reviewed practices.

B.1. Antenatal Corticosteroid Dissemination Study

LBW PORT Objective 6: To implement and evaluate a large-scale targeted dissemination study.

After a year of evaluating practices aimed at the prevention of low birthweight and its major sequelae, the LBW PORT determined that improving obstetricians' use of antenatal corticosteroid therapy in preterm delivery would be an excellent focus for a large-scale dissemination study. Antenatal corticosteroid therapy met the LBW PORT's criteria for selection of an obstetrical practice important for large-scale dissemination:

1) There is sufficient evidence that corticosteroids given to the mother within a specified period of time prior to preterm delivery significantly reduces the rates of neonatal mortality and many of the major morbidities associated with preterm birth.

2) There was considerable variation among obstetricians in their use of this therapy and opinion about its effectiveness overall and in certain clinical conditions.

Background

Appropriate use of corticosteroids in preterm labor is one of the most effective strategies available for the prevention of mortality and disability in preterm infants. Evidence from randomized controlled trials dating back to 1972 showed that the use of corticosteroids in preterm delivery for fetal maturation was effective in reducing infant mortality by 30% and neonatal respiratory distress by 50 percent. Despite the evidence, however, this therapy was highly underutilized until recently. To address these issues, on February 28-March 1, 1994, the National Institutes of Health convened a Consensus Development Conference on the "Effect of Antenatal Corticosteroid Therapy for Fetal Maturation on Perinatal Outcomes." The LBW PORT's Principal Investigator and Co-Principal Investigator were members of the

Consensus Panel that reviewed the evidence for this conference and formulated a consensus statement based on this evidence. In addition, several other LBW PORT investigators presented original research findings to the conference. Specifically, evidence reviewed by the LBW PORT and presented to the NIH Consensus Conference suggested that the appropriate administration of antenatal corticosteroids also significantly reduced the rate of severe intraventricular hemorrhage (IVH) in the very preterm baby (24-28 weeks GA), a major cause of disability, retardation, and death. [6,75]

Despite the strength of the evidence for effectiveness of corticosteroids therapy, review of existing data sets suggested there was considerable variation in the use of antenatal corticosteroid therapy among obstetricians in the major perinatal centers across the country. Since previous consensus conferences had not been shown to be very effective in influencing physician practice, adoption, behavior, or opinion, the LBW PORT in consultation with AHCPR and our National Advisory Panel, and in collaboration with the NIH Consensus Conference sponsor, decided to implement a randomized controlled trial of an active dissemination strategy focused on the NIH Consensus Panel's recommendations to improve the use of corticosteroids in preterm birth.

Pre-Dissemination Analysis of Variation in Practice and Opinion

To better understand the reasons for the variation in obstetricians' use of corticosteroids and to inform the design of the dissemination intervention strategy, the LBW PORT undertook a series of key informant interviews and focus groups with obstetricians around the country. We also conducted a secondary data analysis of data from eight multicenter databases. Data gathered through these two methods were presented to the Consensus Conference and were influential in the crafting of the Consensus Statement message. The findings from these analyses were also published with the other Consensus Conference presentations and findings in a supplement of the *American Journal of Obstetrics and Gynecology* (July 1995; vol.173, no.1).

Data from the secondary data analysis looked at the determinants of use by pregnancy and infant characteristics (i.e., birth weight, sex of infant, gestational age at birth, multiple births) and also by context of delivery (i.e., delivery at perinatal center, cesarean delivery, use of labor-inhibiting drugs, maternal race, and prenatal care status). This analysis showed that although there was considerable variation in overall use between the centers in the late 1980s (13.9 percent to 34.0 percent), there were certain consistencies in the patterns of use. For example, the therapy was used much less frequently in very preterm births (gestational age less then 28 weeks), and much more frequently when cesarean section was performed or labor-inhibiting drugs were used. These tendencies suggested that greater certainty of the timing and inevitability of the delivery encouraged use.[13]

The primary data gathered from the key informant interviews and focus groups were obtained to help us better understand the obstetrician-level opinions about antenatal corticosteroid therapy and the possible reasons for its underutilization. The findings from our exploratory analysis suggested that obstetricians as a group may share certain beliefs and practices that delay or interfere with the appropriate use of corticosteroids.[74] Some of these beliefs and practices (i.e., reasons for under use) follow:

- Obstetricians perceive the benefits of corticosteroids as lower than they actually are. For example, obstetricians were not convinced that corticosteroids improve outcomes in the very preterm infants (or, in cases of worsening pregnancy-induced hypertension [preeclampsia]). These beliefs were based on earlier controversial findings published in the literature.
- Obstetricians are often more concerned about risks than their own experience or the data would warrant. For example, because steroids can mask underlying infection and based on rare events such as maternal death from infection or neonatal sepsis, obstetricians believed that giving women with premature ruptured membranes corticosteroids would place them and their newborns at higher risk of sepsis, even though the empirical data did not support this fear.
- Some obstetrical preterm labor management strategies may delay optimal steroid administration. For example, the following were the most common reasons obstetricians gave for delaying administration of corticosteroids: the use of tocolytics (a drug given to try to inhibit or stop preterm labor); an arbitrary period of observation (ranging from 12-48 hours) prior to steroid administration,

with or without the use of tocolytics; and, the practice of testing for infection or lung maturity prior to steroid use.

Based on these three paradigms and our knowledge of the dissemination and intervention literature, the LBW PORT decided that an active multi-pronged strategy would be optimal for disseminating the NIH Consensus Statement recommendations, and that the message should be clearly and simply crafted to include the following points:

- There are clear indications for use. Basically, all women at risk for preterm delivery between 24 and 34 weeks' gestation are candidates for corticosteroid therapy.
- There are few contraindications.
- The benefits of corticosteroids for improving preterm birth outcomes far outweigh the risk of infection.
- Give steroids in a more timely fashion.

Study Design and Methods

The study was designed as a multi-site randomized controlled trial to test the effectiveness of a low-cost, targeted dissemination intervention aimed at improving the appropriate use of antenatal corticosteroids for preterm delivery. The hospital was the unit of assignment. Because one of the conditions of hospital participation was that individual physicians not be studied, patients (or deliveries in this case) served as the proxy for physician behavior.

Twenty-seven hospitals (perinatal centers with large numbers of preterm births) from across the country were recruited through the LBW PORT's collaborations with the National Perinatal Information Center's (NPIC) Perinatal Center Network (contributing 19 study sites) and the Albert Einstein College of Medicine's (AECOM) network of affiliate hospitals (contributing 8 sites). Hospitals were randomly assigned to treatment condition involving "active" dissemination or "usual" dissemination of the NIH recommendations. The time period for the study involved the 12-month period prior to the release of the NIH Consensus Statement, referred to as the "Baseline Year" (March 1993-February 1994), and the 12-month period after national release of the Consensus Statement during which the intervention took place, referred to as the "Post-Consensus Conference Year" (April 1995-July 1996). Due to the nature of the interventions, implementation had to be staggered over the 13 treatment hospitals from April 1995-July 1995; therefore, the intervention year-end dates were staggered as well. This design allowed the LBW PORT to compare the change in use of this therapy under two conditions: (1) usual dissemination of the NIH Consensus Statement, and (2) active dissemination, LBW PORT's year-long education and feedback intervention.

NIH (Usual) Dissemination

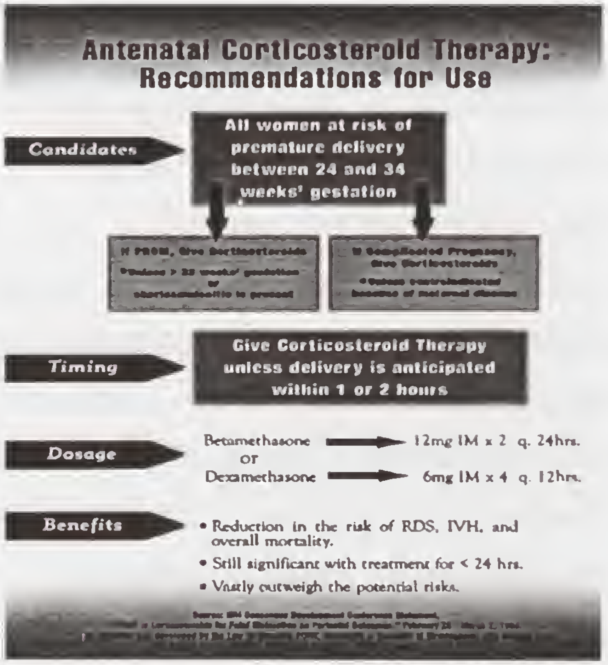
- Large national mailing of NIH Consensus Statement brochures to obstetricians and health care providers.
- Publication of the Statement in two leading journals: *JAMA* and the *American Journal of Obstetrics and Gynecology*.
- Endorsement of recommendations by the American College of Obstetricians and Gynecologists via a separately disseminated Opinion Statement. This endorsement, however, did not agree with the recommendations on use in cases of premature rupture of membranes.

LBW PORT (Active) Dissemination

- On-site facilitation by an Obstetrician Opinion Leader and a Nurse Coordinator.
- Grand Rounds emphasizing the beneficial effects of corticosteroids given by a national expert involved in the Consensus Panel.

- Chart reminder system combining a chart insert which summarized and reinforced the NIH recommendations and a brightly colored sticker prompting timely administration of corticosteroids.
- Group consensus building through small group discussion of case scenarios.
- Feedback of treatment group hospital-level monitoring and tracking data on use of steroids and compliance with the reminder system.

The overall message of the active dissemination was simple, emphasizing the benefits of corticosteroids and the basic recommendations for use. This is perhaps best illustrated by the chart insert developed for the chart reminder system (see Figure 2).



Antenatal Corticosteroid Therapy:
Recommendations for Use

Candidates

All women at risk of premature delivery between 24 and 34 weeks' gestation

Timing

Give Corticosteroid Therapy unless delivery is anticipated within 1 or 2 hours

Dosage

Betamethasone → 12mg IM x 2 q. 24hrs.
or
Dexamethasone → 6mg IM x 4 q. 12hrs.

Benefits

- Reduction in the risk of RDS, IVH, and overall mortality.
- Still significant with treatment for < 24 hrs.
- Vastly outweigh the potential risks.

Figure 2. **Chart insert developed by the Low Birthweight PORT.**

The main outcome measure for the evaluation of the effect of the dissemination intervention strategy was the change in administration of corticosteroids in preterm deliveries between 24.0 and 34.6 weeks' gestation. Data collection for the main outcome variable was from the maternal medical record. With respect to the main outcome measure, the data collection was designed to answer three main research questions:

- Will use of corticosteroid therapy increase after the NIH Consensus Conference?
- Will a low-cost, active dissemination effort increase use of the therapy over and above the Consensus Conference increase?
- How will the dissemination affect use of the therapy with respect to certain patient/delivery characteristics?

In addition to the main outcome measures, overall evaluation of the dissemination effort involved the collection of implementation monitoring and tracking data, as well as certain organizational and environmental data for the purpose of understanding the issues that may impact dissemination at the individual hospital level. The strategies for collecting this data included:

- Site visits and structured interviews with opinion leaders (key informants).
- Pre-test/post-test for evaluation of Grand Rounds.
- Information on attendance at Grand Rounds.
- Standardized data entry logs for ongoing collection of monitoring and tracking data.
- Information on attendance, comments, and consensus level from case scenario group discussions.
- Interim and final narrative reports from nurse coordinators.

Sampling Strategy and Clinical Data Abstraction

Eligible cases for chart abstraction at each of the 27 study sites included all women who delivered preterm between 24.0 and 34.6 weeks' gestation. The original goal was to obtain an equal sample of 150 eligible deliveries per hospital. However, due to census differences between hospitals and between study years, the sampling strategy had to vary. In order to obtain an average of 150 cases per hospital, the LBW PORT determined it would be necessary to over sample the larger hospitals up to 162 cases. The team also determined that it would be necessary to over sample the larger hospitals for the very preterm deliveries (i.e., 24-28 weeks' gestation); a gestational age group that previously received fewer corticosteroids and in which the majority of cases of preterm premature rupture of membranes (PROM) would be expected. (As previously noted, PROM was found to be of considerable concern to obstetricians with respect to the increased risk of maternal and neonatal infection. However, the empirical data did not support this level of concern.) Because the number of very preterm deliveries is very small for any given hospital, over sampling these smaller babies would allow for a more sensitive measure of the effects of active dissemination.

The deliveries were sampled as follows: (1) in hospitals with fewer than 150 deliveries, we sampled the universe of deliveries between 24 and 34 weeks; (2) in hospitals with 150 or more, we sampled all 24-28 weekers and then took a random sample of the 29-34 weekers up to 162; and (3) for two hospitals with large numbers of deliveries between 24 and 28 weeks, it was determined that all deliveries between 24-34 weeks would be randomly sampled, because over sampling the smaller babies would overwhelm the sample in these institutions.

Using these sampling strategies, a total of 6,798 eligible preterm deliveries (i.e., between 24 and 34 weeks' gestation) were abstracted from the 27 study hospitals, 3,516 in the Pre-Consensus Conference (Baseline) year, and 3,282 in the Post-Consensus Conference (Treatment) year. Information abstracted from the mother's record included: demographic and maternal data such as mother's age, marital status, race, payer source, parity, site of prenatal care, and number of visits (when available from the chart); admission data such as date and time of admission and discharge, and whether or not the woman was transported from another institution; pregnancy-related admission information such as the obstetrician's best estimate of gestational age, condition of cervix and membranes, presence of uterine contractions, and whether or not corticosteroids were administered prior to admission (if the patient was transferred); information on in-hospital use of corticosteroids and certain labor-inhibiting drugs; documentation of the presence of certain maternal complications/conditions (i.e., hypertension/preeclampsia, chorioamnionitis, diabetes, heart disease, and other); information on the event that precipitated delivery (i.e., whether the delivery was categorized as spontaneous preterm labor, PROM with or without labor, or indicated delivery due to maternal or fetal complications); finally, initial delivery outcome data (i.e., birth date, number of babies, type of delivery [vaginal or cesarean section], condition at delivery, Apgar scores, and birthweight).

Analysis Strategy

Due to the nested design of the study, the analysis utilized multi-level logistic regression modeling, a method that is now acknowledged to be superior for this type of study design. This method acknowledges that both the hospital and patient levels of analysis must be considered in order to understand the physicians' response to the Consensus Conference. A two-level logistic regression model was designed to allow evaluation of the impact of an active dissemination effort at the hospital level on use of corticosteroids, while controlling for: (1) the effect of the Consensus Conference, (2) the individual patient characteristics which we hypothesized would be important with respect to the determinants of use, and (3) the individual hospital's historical level of corticosteroid use.

The patient-level variables considered in the analysis were: study year (Baseline versus Post-Conference); corticosteroid use (received versus not); gestational age 24-28 weeks compared with 33-34 weeks; gestational age 29-32 weeks compared with 33-34 weeks; and diagnosis of PROM as indication for delivery. Regarding PROM, because there were too few cases of indicated preterm delivery (i.e., delivery for maternal or fetal reasons), the model contrasts spontaneous labor leading to delivery with PROM leading to delivery (labor following or not).

The hospital-level variable is treatment condition (active versus usual dissemination). For practical reasons, a conservative model was estimated in which the coefficients for the main effects (patient-level variables described above) were allowed to vary randomly across hospitals.

Findings From the Primary Analysis

Findings regarding change in use of corticosteroids. Figure 3 reflects the overall change in use from Baseline year to Post-Consensus (Treatment) year in the active dissemination hospitals (treatment group) versus the usual dissemination hospitals (control group). While there was an overwhelming increase in corticosteroid use in both groups, there was an even greater increase in use for the treatment group.

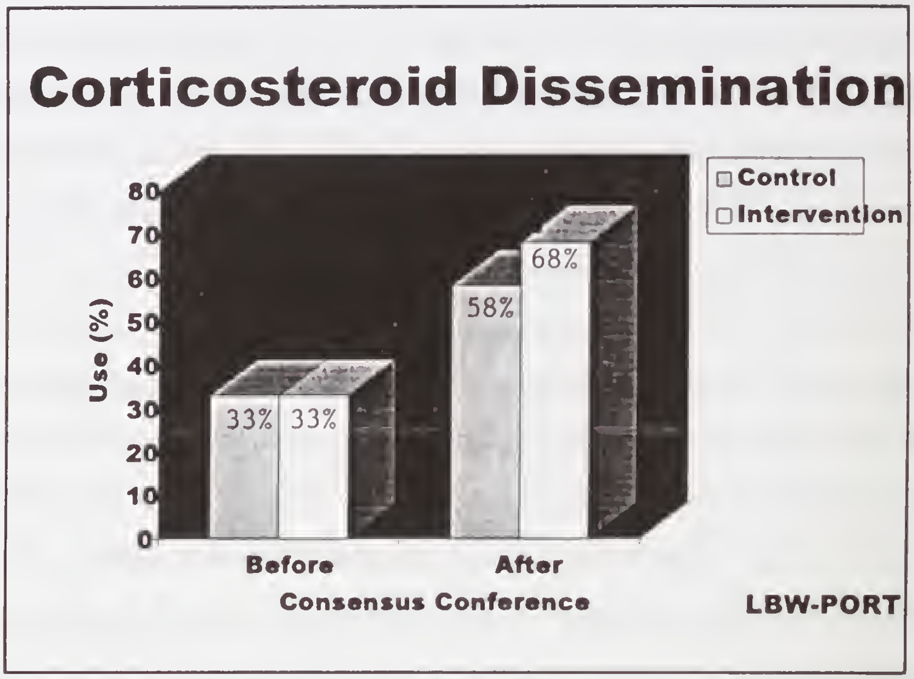


Figure 3. Overall change in use from Baseline to Post-Conference

Table 2 shows the patient-level results of the analysis which reflects a 33 percent increase ($p<.01$) in the treatment hospitals over and above the effect of the NIH Consensus Conference (control hospitals). However, Table 3 (hospital-level results) shows that results of the analysis of the two-level logistic regression model which reveals an even greater effect of the study year—an increase of +45 percent ($p<.01$).

Table 2. Patient-Level Results | Table 3. Hospital-Level Results

	Usual Dissemination (%)	Active Dissemination (%)	Difference (%)	Usual Dissemination (%)	Active Dissemination (%)	Difference (%)
Baseline	33.0 (N=1,683)	32.9 (N=1,739)		34.2 (N=14)	32.6 (N=13)	
Post Conf.	57.6 (N=1,654)	68.3 (N=1,585)		57.4 (N=14)	69.4 (N=13)	
% Increase	75	108	+33	68	113	+45

As seen in the two-level logistic regression model (and controlling for other variables in the model), the expected increase in the odds of corticosteroids use after the Consensus Conference (compared to Baseline) is 3.16. In usual dissemination hospitals, the use of corticosteroids increased 75 percent from Baseline to Post-Conference year. In active dissemination hospitals, however, the intervention strategy gave a statistically significant boost to the effect of the Post-Conference study year. The active dissemination increased the odds of administering corticosteroids during the Post-Conference year by a factor of 1.63 ($p < .01$). In active dissemination hospitals, use of corticosteroids increased 108 percent from Baseline to Post-Conference year—more than one-third as much as in the control hospitals.

Findings regarding patient (delivery) characteristics. We also looked at changes in use with respect to the patient (delivery) characteristics which we hypothesized would be likely to reflect differences in practice from Pre-Consensus Conference Baseline use (as described by our preliminary exploratory analyses of opinion and practice) to Post-Conference use. Gestational age (GA) and the presence of PROM were associated both with Baseline corticosteroid use and with the Post-Conference increase. In contrast to what we expected, in both study years, patients with lower GA (24-28 weeks and 29-32 weeks) were significantly more likely to receive corticosteroids than those with higher GA (33-34 weeks). Compared to GA 33-34 weeks, the Baseline odds ratio was 4.48 for GA 24-28 weeks, and 2.95 for GA 29-32 weeks. In addition, the actual increase in GA 24-28 weeks from Baseline to Post-Conference year was significantly less than for GA 33-34 weeks. However, as hypothesized, patients with PROM were significantly less likely to receive corticosteroids in the Baseline year than those without PROM (odds ratio$=$0.63, $p < .01$), and corticosteroid use in PROM increased significantly from Baseline to Post-Conference year.

Findings regarding variation in treatment response. Hospitals showed extreme and statistically significant variation in their use of corticosteroid therapy both before and after the Consensus Conference. In addition, hospitals varied radically in the response to the dissemination condition. The bar chart in Figure 5 shows this variation among hospitals by treatment group and response to the dissemination condition (i.e., usual versus active). Hospitals are ranked within each treatment group by their Baseline rate of corticosteroid use.

As can be seen, some hospitals increased use only minimally while others changed radically. There were also hospitals that were radically different from the rest of the group in high or low use at Baseline in both treatment and control groups.

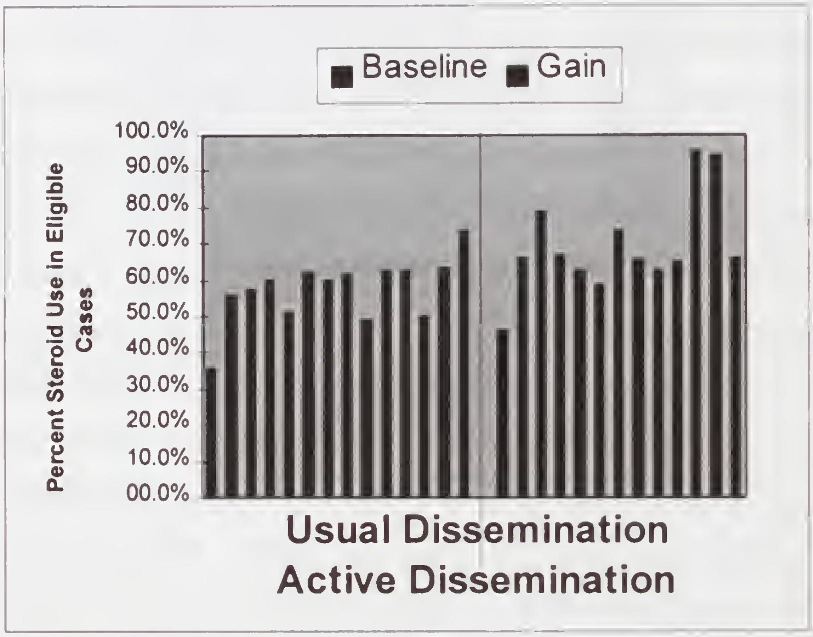


Figure 4. Variation among hospitals in percent use and percent gain in use Baseline vs. Post-Conference: grouped by treatment condition and ranked by baseline percent use.

Conclusions Regarding the Primary Analysis

The year after the NIH Consensus Conference reflected a marked change toward increased use of corticosteroid therapy. However, the LBW PORT's active dissemination effort significantly increased adoption of the NIH recommendations over and above the effects of the usual Consensus Conference dissemination. We hypothesize that this occurred not only because conditions were favorable for adoption of the NIH recommendations, but also because active dissemination was tailored to the needs and concerns of the target group of obstetricians at the study hospitals.

Discussion

In the 12 months after the NIH Consensus Conference, use of corticosteroids increased dramatically across both active and dissemination hospitals. Although other influences may have been involved, it is very likely that the Consensus Conference recommendations encouraged this increase. As discussed in an earlier section, the Consensus Conference Statement was crafted to address obstetricians' concerns about the risk of steroids. There was also an endorsement by the American College of Obstetricians and Gynecologists (ACOG)—a major player in setting national practice standards for obstetricians—of all but the recommendations for use in PROM. However, as is suggested by the high use in many hospitals at Baseline, it may have been that the conditions in general were right for change. The study hospitals were all tertiary regional care facilities and most were affiliated with academic institutions, making them more likely to be early adopters of technologies. Since there was a growing body of evidence and change over time in opinions in the academic obstetrician community, this may have provided a highly favorable condition for the Consensus Conference message. Also, there were no competing special interests or therapies.

Regarding the lack of effect of the active dissemination effort on the increase in use for cases of PROM, it is possible that obstetricians still find PROM to be the test case for a philosophy of care concerning use of steroids. Because this was an area where there had been considerable controversy, the NIH recommendations specifically addressed the concerns about the increased risk of infection and the previous findings that the benefits to the fetus were less in cases of PROM. The LBW PORT's educational intervention components highlighted the evidence in support of use in PROM. The hospitals in our study were using steroids in PROM more than was expected at Baseline, and knowledge of the NIH dissemination message may have further hastened a change in this philosophy, leaving little room for any "active" dissemination effect. Also, again, we note that we were dealing with early adopters with respect to the tertiary and academic nature of the institutions involved in the study. Therefore, although this pattern was not predicted based on the earlier data regarding obstetricians' practices and opinions, we speculate that because the timing of a PROM delivery is more under the control of the obstetrician than is a spontaneous preterm labor delivery, and because the

NIH message clearly addressed the benefits over the risks of this therapy in cases of PROM, this was indeed an area more conducive to change.

Regarding the smaller effect of both the Consensus Conference and the LBW PORT's active dissemination on use of therapy in the lower gestational age deliveries, again, our study hospitals were using at a higher rate than expected, almost 50 percent of the time at Baseline. This presented another situation where there was a possible ceiling on the effect size that could be expected. This was another area where the earlier data suggested corticosteroids were very underutilized, and for which there had been controversy about the benefits of therapy; however, it is possible that the dramatic improvements in the survival rates and outcomes for these very preterm infants had created an environment in which our tertiary care obstetricians had to resolve this controversy quickly. They were more aware of the benefits as the result of their exposure to the neonatal intensive care setting and the team approach with neonatologists common to this setting with respect to managing preterm deliveries. As mentioned earlier, our qualitative research had suggested this to be the case.

Implications

Even considering all of this, the active dissemination effort caused an important change, over and above the influence of the Consensus Conference impact. At a minimum, the analysis demonstrates that an active dissemination hastened adoption of the therapy. In addition, the low-cost nature of the dissemination suggests that this active strategy can be effective and is very feasible at the local level. We estimated a per-hospital cost of less than $10,000 for this type of intervention. This is a small input, given the Consensus Conference estimation of a savings to society of $3,000 per neonate due to improved outcomes associated with corticosteroid use. The improved outcome of just four neonates would more than pay for the cost of the intervention. The effectiveness, low cost, and reduced effort of educational strategies such as this one should make them of interest to those agencies and organizations involved in the development of national practice guidelines. We believe that the results of this study suggest that educational strategies that involve the right messenger and which are implemented when the overall climate for change is right can be effective in hastening the adoption of practice recommendations. We also believe that we have demonstrated the usefulness of formative exploratory research for informing the dissemination of practice recommendations.

Plans for Further Analysis

Given the overall effectiveness of the dissemination, there was still significant unexplained variation that should be explored further. The LBW PORT dissemination team plans to use the multi-level techniques employed in the primary analysis to further model the between hospital variation in their treatment response. We will use both qualitative data collected in the field during the intervention, as well as the quantitative data from the maternal chart review to address the questions that developed as the result of our summary or hospital implementation data. We have developed several working hypotheses which will form the basis of our continued analyses. These questions center around the issues of organizational complexity and institutional culture as well as certain Opinion Leader characteristic variables that resulted from our coding of Opinion Leader key informant interviews and other qualitative data collected from the field.

Additional analysis planned with respect to measuring the impact of the dissemination involves the analysis of infant outcomes using the maternal chart data abstracted in the field linked to the NPIC's infant hospital discharge data set and hospital discharge data provided by the AECOM study hospitals. By merging these two data sources, we will have data on infant mortality and morbidity as well as other outcomes data such as length of stay and resource use/cost (NPIC data set only). We have not been able to complete these analyses prior to the Final Report, due to problems with the NPIC merge rates. Because unique matches were not available via the presence of the baby medical record number in the maternal chart, the NPIC hospital babies had to be linked through a series of complex matching algorithms. Analysis of these data are pending the success of these merges. We are presently attempting to correct the problems in cooperation with the NPIC. If the problems can be corrected, we will complete the infant outcome and cost analysis as proposed. We will also plan a separate analysis on the AECOM infant discharge data as soon as data entry can be completed.

B.2. Prenatal Intervention Trial: Mother and Family Specialty Center

LBW PORT Objectives 3 and 4: To measure the overall effectiveness of the different practices by examining their association with pregnancy outcomes. To develop clinical and care system recommendations to reduce the prevalence of low birthweight and its negative sequelae.

Background

The randomized trial of comprehensive prenatal services for high-risk women, the Mother and Family Specialty Center (MFSC), represented a key activity of the LBW PORT. With the exception of emerging evidence of the role of infections and nutritional supplementation in the prevention of preterm delivery, the literature reviewed during the first year of the PORT, and the secondary data sets explored by the LBW PORT, suggested that many of the risk factors potentially amenable to intervention were associated with psychosocial and behavioral factors. However, the evidence for the effectiveness of the various interventions reported in the literature was at best marginal.

Earlier studies might have been unsuccessful in demonstrating that prenatal care could reduce low birthweight births for one or more of the following reasons: (1) in randomized trials, a large proportion of the maternity population was at relatively low risk (e.g., selected on the basis of poverty or ethnicity only), so that the numbers required to reach statistically significant conclusions would have had to be much larger than those included; (2) prenatal care in randomized trials and correlational studies was assumed to be of high quality, but the actual content and quality of care that women received were not documented; and (3) prenatal care typically was measured only in terms of frequency or general clinical aspects without regard to whether the needs of individual patients were adequately addressed, and whether women were informed of how they could reduce their risks. The studies that suggested positive benefits of prenatal care used historical controls or non-randomized comparison groups and thus were likely to be biased by self-selection and other factors.

After consulting with the LBW PORT's National Advisory Panel, the Steering Committee decided to determine whether an intervention offering state-of-the-art medical care and a broad array of educational and social support activities could reduce low birthweight among low-income African American pregnant women who had multiple risks. Rather than test the impact of individual components of prenatal care, this intervention aimed to test a "best practices" package. (A detailed background justification for this approach was provided to AHCPR in the LBW PORT's third progress report submitted in April 1994, and summarized in a letter to the project officer from the Principal Investigator [January 1994]. Additional background justification was provided in the conceptual proposal submitted to AHCPR [progress report 5].)

Study Design and Methods

To avoid the flaws in earlier studies of the effectiveness of prenatal care, the investigators designed a randomized controlled trial of women at elevated risk. They proposed a sample of 600 women, 300 in the intervention group, and 300 in a group that would receive standard care from the Jefferson County Health Department (JCHD) prenatal clinics. The conceptual framework guiding the design of the intervention package was the result of the multidisciplinary collaborative efforts within the LBW PORT. Steering Committee members Lorraine Klerman, DrPH, and Sharon Ramey, PhD, were the principal investigators for this study. They were joined by members of the LBW PORT with expertise in smoking cessation and nutritional interventions. In addition, an ad hoc planning team (consisting of 12 practitioners and researchers with diverse backgrounds and expertise in all areas of prenatal care delivery settings, education, and services) was involved in the design of the intervention project. These health professionals also had extensive experience in serving high-risk inner city African American women. The conceptual framework developed through this process emphasized the interplay of biological and behavioral predisposing factors and the need for a multi-pronged intervention delivered in a culturally appropriate setting and manner.

Prenatal care in the MFSC was designed to meet the many needs of mothers-to-be, beyond just basic prenatal health care. Women received high-quality prenatal care from the same obstetrical nurse specialist every 2 weeks throughout their pregnancy. The content of the prenatal health care was documented and extensive training and monitoring throughout the study was provided to ensure that best practices and up-to-date information were used consistently for participants. Pregnant women were informed about their own individual risks, and systematic efforts were made to promote positive health behavior (such as adequate maternal nutrition to support weight gain, regular use of prenatal vitamins with additional zinc, reduction or elimination of smoking, avoidance of alcohol and other drugs, and preparing for parenthood) as well as providing all needed health care in a timely manner. In addition, an educational and social support group of mothers-to-be met every 2 weeks for 40 minutes, just before or after their regularly scheduled prenatal appointments. The group was led by a trained social worker who presented special information modules at each group session along with an opportunity for group members to share what was happening in their lives. Additional forms of support included assistance with transportation, on-site child care, encouragement to bring other family members and friends to the MFSC, specially prepared take-home videos about aspects of pregnancy and health promotion, on-site availability of social workers to help women with other needs (e.g., housing, WIC, welfare, domestic violence reduction, continued education, or vocational training). Table 4 highlights the major differences between the care received by the MFSC group and by the control group.

The MFSC study population consisted of all Medicaid-eligible women who were seen for their initial prenatal visit at one of the JCDH prenatal clinics. Only pregnant women who were at least 16 years of age and who had their first visit before 26 weeks gestation (subsequently changed to 18 weeks gestation) were potentially eligible for the study. Pregnant women meeting these criteria were screened using data from the JCDH and University of Alabama at Birmingham (UAB) collaborative Automated Obstetrical Record System (OBAR)—in order to determine which patients were eligible for the study.

Women with a diagnosis of substance abuse/addiction; complicating conditions such as asthma, diabetes, high blood pressure, epilepsy, sickle-cell disease, or cancer; or who screened positive for bacterial vaginosis and/or Trichomonas vaginalis were excluded. To be eligible for the MFSC, women had to score 10 or higher on a risk assessment scale developed by the LBW PORT based on prior studies of risk factors associated with low birthweight conducted by members of the obstetric research team. A woman received 10 points if she had

Table 4.

Differences Between the Mother and Family Specialty Center and Typical Care for Pregnant Medicaid Patients

UAB Mother and Family Specialty Center	Typical Care for Medicaid Patients
1. Focus on risk reduction: All mothers-to-be informed clearly, individually, and repeatedly about what their risks are and what they can do to lower them.	1. Focus on general maternity care. Variable levels of informing mothers-to-be about individual risks and how to change.
2. Specific programs related to three major risk conditions: a) Smoking cessation. b) Weight gain and vitamin/mineral supplementation. c) Psychosocial stress/isolation.	2. No specific programs provided for all women to maximize smoking cessation, ensure weight gain and taking daily vitamin/mineral supplements, or enhance psychosocial situation.
3. Appointments and group sessions every 2 weeks throughout pregnancy (once per week during last month).	3. Appointments monthly until 28 weeks, bi-monthly from 28-36 weeks, and weekly after 36 weeks.
4. Regular "standing" appointment: No need to schedule each time.	4. Each appointment scheduled at prior visit: If appointment is missed, patient must contact clinic for re-schedule and/or next appointment.
5. No waiting time: All patients are seen within 5 minutes of scheduled session.	5. Variable waiting time (average is more than 1 hour).
6. Evening hours and weekend time slots available.	6. Usually, only standard work-week hours.
7. Individualized care with the same health care practitioner.	7. Care with multiple practitioners.
8. Forty-minute private sessions with practitioner (more if special conditions warrant).	8. Variable time (10-40 minutes).
9. Health care record given to patients and updated (or replaced, if lost) at each visit with key/relevant information.	9. No health care records given to patients.

Table 4. (Cont.)

Differences Between the Mother and Family Specialty Center and Typical Care for Pregnant Medicaid Patients

UAB Mother and Family Specialty Center	Typical Care for Medicaid Patients
10. All women receive two reminders prior to each appointment (one phone call, one mailed card).	10. Reminders typically not provided.
11. Transportation provided (via taxicab or bus vouchers paid by the Center) whenever needed.	11. Some assistance with transportation provided, but not available to all.
12. Child care provided at Center (with planned activities and snacks).	12. No child care available.
13. Fathers-to-be, relatives, and friends encouraged to come to the Center and join in the group.	13. No special outreach to fathers-to-be, relatives, or friends.
14. Physical environment designed to provide welcoming and positive messages, culturally appropriate images, snacks and beverages, comfortable seating, and easy directions to labs/special rooms. (Setting conveys a celebration and affirmation of pregnancy, families, and community.)	14. Variable settings, many are minimal in terms of positive messages, comfort, and cheerfulness.
15. Discussion groups (40 minutes) held as an integral part of each Center visit. Purpose: a) To strengthen positive feelings about pregnancy, parenthood, and self. b) To increase social support and contact with other pregnant, high-risk women. c) To convey highly important information.	15. No systematic provision of groups or social support with other pregnant women.
16. Information compiled and distributed to mothers-to-be in readily accessible formats. This includes: Specially prepared information videos and print materials related to weight gain/nutrition, smoking cessation goal setting, labor and delivery, and the Specialty Center. Additional materials are compiled from many sources and are available in the lending library.	16. Some print information available, but often limited in substance and not targeted directly to the high-risk population group.

a prior birth between 25 and 36.6 weeks; had a prepregnancy weight of 50 kilograms or less; or did not have her own or a family car available for transportation. Five points were given for a previous term intrauterine growth-retarded (IUGR) infant; smoking at the time the woman became pregnant; agreeing with the statement, "There is little that I can do to change many of the important things in my life;" and a body mass index (BMI) of less than 19.8.

Pilot Implementation and Evaluation Period

The formal MFSC randomized trial began on April 24, 1995. However, in November 1994, a pilot implementation study or formative evaluation was initiated to test the screening and recruitment strategy, flow of the clinic, and intervention strategies. During this pilot phase, 50 pregnant women were studied. Two 4-hour clinics were held each week: an evening clinic and a morning clinic. Women came every 2 weeks to the same clinic. The decision to provide women with a choice between an evening or morning clinic was based on findings from a previous survey regarding women's preferences conducted by the UAB Department of Obstetrics. During this pilot period, staff met for eight in-service training sessions to review and modify protocols and to develop an operations manual. In addition, the principal investigators held weekly staff meetings to review the clinic operations and to conduct individualized case reviews. Also, data collection and evaluation forms were developed and revised for the following areas:

1. Scheduling, attendance, and amount of treatment per patient.
2. Participation in group sessions and individual response to each session.
3. Initial intake form including nutrition, smoking, and psychosocial history.
4. Forms for recording treatment and monitoring of patient progress on a bimonthly basis.
5. Supplemental information regarding patient problems.

Ongoing evaluation of the project was iterative and process-oriented, allowing for modification to protocols as women provided feedback to staff and staff provided feedback to investigators. Changes to the materials and forms were documented and submitted to the Project Officer in required progress reports.

Data Collection and Analysis of the MFSC

Investigators and staff worked closely with the JCDH and with the Jefferson County WIC program to maximize the use of existing data forms by both the treatment and control groups. In addition, specialized data collection forms were developed for the MFSC by the co-investigators with the assistance of the research nurse manager and the clinical staff. These forms included: the Screening Questionnaire that contained the risk assessment score; special forms for MFSC Visits 1, 2, and 3 that collected background information on each woman, allowing the nurse to tailor her counseling to the woman's needs; and a subsequent encounter form for use at each visit after the first. Other data collection forms included a nursing education checklist, a visit planning worksheet, and a smoking cessation assessment. These data were collected and entered as part of each patients' prenatal visit. These treatment data were linked to data collected and entered into the previously described OBAR system for both the MFSC and the JCDH control group. Clinical outcomes data on the course of labor and delivery and the status of the newborn were abstracted from the mother's and baby's medical record for both MFSC and JCDH control groups by trained research nurse abstractors working for the UAB Department of Obstetrics and Gynecology.

In addition, women who were seen at the MFSC and the JCDH control group women who entered the study after June 1, 1996, were scheduled for a followup interview approximately 6 weeks after delivery to obtain data on their perceptions of care. This data set will be important for evaluating women's understanding of their risk factors, as well as for exploring questions regarding behavioral changes during pregnancy, knowledge about childbearing, and perceptions about the quality and appropriateness of the prenatal care received. Understanding the pregnant woman's involvement in her prenatal care and reasons contributing to behavioral change (or lack of change) is important in evaluating the impact of the treatment and its potential to mediate pregnancy outcomes.

The multiple data sets from the LBW PORT's MFSC will allow the investigators to determine:

- The impact of the MFSC on pregnancy outcomes (low birthweight, preterm delivery, IUGR, fetal death, and number of days mother and infant spent in the hospital after delivery).

- The MFSC's effect on intervening variables such as weight gain, taking vitamins, smoking cessation or reduction, stress and depression, and frequency of prenatal appointments.
- The impact of the MFSC on the number of emergency room visits and hospitalizations during pregnancy.
- The characteristics of the women associated with more or less positive behavior changes and outcomes in the MFSC population.
- How women perceived the helpfulness or quality of their prenatal care.

The last MFSC study patient delivered on July 12, 1997, completing the randomized controlled trial. Data collection on deliveries and postpartum interviews were completed in August/September 1997. Data editing and cleaning for the MFSC was ongoing during the study. Program staff have linked clinic and delivery data for the MFSC group and merged the MFSC data set with data for the JCDH control group through the OBAR system. Postpartum interviews were conducted with 228 (76 percent) of the 300 women who were targeted.

Preliminary Results

A total of 656 women were enrolled in the study. (Note: Analyses presented here are for live-born infants only and are based on a subset of 431 women who began prenatal care before 18 weeks' gestation and who delivered in area hospitals.) There were six fetal deaths in the MFSC or "Augmented Care" group (three before 20 weeks and three at 20 weeks or later), as compared to four fetal deaths in the JCDH or "Usual Care" group (three before 20 weeks and one at 20 weeks or later).

Primary Outcomes

Although the percentage of infants born preterm was slightly lower in the Augmented (MFSC) than in the Usual Care (control) group (11.7% percent versus 13.5 percent), the difference was not significant. In terms of gestational age and low birthweight, the two groups did not differ significantly. Similarly, rates of low birthweight in the two groups did not differ significantly, although there was an excess of low birthweight males in the Augmented Care group. Also, there were no significant differences in prematurity (< 37 weeks' gestation) or

IUGR status (using Williams standard), except for the excess of males in the IUGR Augmented Care group. The 1- and 5-minute Apgar scores were almost identical in the two groups.

Although rates of cesarean section deliveries were reduced in the Augmented Care group (16.0 percent) compared to the Usual Care group (21.6 percent), this was not significant. Stays in the neonatal intensive care unit (NICU) and congenital anomalies also were lower, but not significantly so for those in Augmented Care versus Usual Care.

Note: Because the randomization process did not lead to completely comparable groups in terms of maternal risk and child sex, multiple regression analyses were used to control for baseline differences that might have affected pregnancy outcomes. Even after controlling for these possible influences, the Augmented Care group showed no significant improvements related to birthweight, low birthweight rates, IUGR status, or gestational age. Further post hoc analyses also considered the fact that 13 of the 219 Augmented Care women *did not* actually receive care at the JCDH. Even when these cases are deleted or are placed in the Usual Care group, the conclusions remain unchanged.

Behavior Change

The study was predicated on the belief that if women's behavior changed in a positive way, and frequent high-quality prenatal care was provided, pregnancy outcomes would improve. Therefore, the investigators are examining the data to determine whether targeted behavior change actually occurred as a result of the MFSC's augmented prenatal care. Preliminary findings are mostly positive, however, and most did not reach statistical significance.

Based on self-report of women during a postpartum interview, smokers (less than 25 percent of the participants in MFSC Augmented Care) did report smoking cessation at a significantly higher rate than did those in Usual Care (53 percent versus 24 percent, respectively). The validity of this self-report, however, was not determined (e.g., biochemical affirmation).

Weight gain was greatest for mothers with low BMI (< 19.8) compared to higher BMI when enrolled. Specifically, those in the Augmented Care gained an average of 15 kg (SD=6.3) versus 13.7 kg (SD=6.5) for those in the Usual Care group, although this was not a statistically significant difference. Regarding taking prenatal vitamins regularly, there was no significant difference despite vigorous intervention efforts in these areas. Close to one-third of the women in both groups did not take vitamins daily or almost daily. Rates of alcohol, cocaine, and other non-prescription drug use were low for both groups and no reduction in use appeared for either group. Again, these results are based on self-report data.

Concerning women's knowledge of their own risk conditions, 41 percent of those in Augmented Care accurately identified their risk factors, compared to 31 percent in the Usual Care group—again, not a statistically significant group difference. Somewhat remarkably, however, women receiving the Augmented Care reported almost unanimously (95 percent) that the care was "very helpful," while 79 percent of those receiving Usual Care provided equally high ratings ($p < .01$). Further, those women who previously received prenatal care elsewhere judged their current care as decidedly and significantly better ... if they were in the Augmented versus Usual Care group.

Discussion and Implications

One of the most often cited reasons for poor pregnancy outcomes among very low income African American women is that they receive inadequate prenatal care in terms of quality and quantity. However, the previous scientific support for this conclusion was very limited. This belief was based largely on correlational relationships—that is, women who received more frequent, higher quality prenatal care tended to have better pregnancy outcomes. A number of small-scale trials of prenatal interventions *did not* show anticipated benefits.

Our recent data indicate that despite the active regular participation of all but a few women in the multiple components of the MFSC Augmented Care, low birthweight was not significantly reduced in their infants compared to those of controls who received traditional prenatal care through the health department. Similarly, other pregnancy outcomes were not improved, despite the very high ratings of the helpfulness of prenatal care by participants, and the fact that they received significantly more frequent care ($M = 14.7$ visits, $SD = 3.6$) than did those in the Usual Care ($M = 12.6$ visits, $SD = 3.9$). The MFSC Augmented Care women also participated actively in group sessions and seldom missed scheduled appointments.

These findings are very important for public policy. They indicate that prenatal care by itself, even when it is of very high quality and provided in a culturally appropriate and individualized manner, *will not* be a major factor in reducing rates of low birthweight among children born to African American women. At the same time, the findings support the potential value of prenatal care for helping low-income, minority women become more knowledgeable about their pregnancies and the future care of their infants. Clearly, a supportive prenatal center can contribute to positive maternal behavior change. This is important to know, particularly if it is discovered that other biomedical conditions *that are treatable* are the major reason for low birthweight. That is, a supportive prenatal care setting will be essential to ensuring that high-risk women receive timely medical treatment for specifically delineated causative factors contributing to the disproportionately high rates of low birthweight among minority women.

Plans for Further Analysis and Dissemination

The investigators have outlined three papers addressing the research questions of interest:

1. What can comprehensive high-quality prenatal care, in combination with risk-factor targeted interventions, accomplish in a population of African American multi-risk women and their children?

    This paper would expand the results provided in this report. It would also review earlier studies of prenatal care, as well as the background, purpose, unique features, and study design of this project.

2. Who does and does not engage in high-risk behaviors as contrasted with health-promoting behaviors during pregnancy?

    This paper would describe the characteristics of women who do and do not change their risk-related behaviors. The analysis would also assess whether or not patients' awareness of their risk factors and related poor pregnancy outcomes increased during their care.

3. What was the impact of the MFSC on weight gain, eating patterns, and other nutritional factors?

    This paper would present a detailed analysis of data collected on weight gain and nutritional status during pregnancy, and discuss whether the nutritional intervention was associated with positive outcomes.

B.3. Ongoing Research Activities and Dissemination: Literature Reviews, Secondary Data Analyses, and Decision Analyses

LBW PORT Objectives 1-5: (1) To identify variations in practices occurring during the management of pregnancy that aim to prevent low birthweight and related sequelae; (2) to explore the causes of these variations; (3) to measure the overall effectiveness (including cost effectiveness) of the different practices and their associations with pregnancy outcomes; (4) to develop clinical and care system recommendations regarding the relative effectiveness of studied practices; and (5) to disseminate research findings and recommendations in a targeted manner.

The LBW PORT applied the PORT process to studying practices of interest with respect to low birthweight and its sequelae. Investigators have utilized the methodologies of literature review and synthesis, decision analytic and cost-effectiveness analysis, and the exploration of existing data sets to study practice variation and effectiveness and to further define our knowledge of the determinants of preterm delivery and fetal growth restriction. An overview of these ongoing PORT research activities is provided in the Table of Low Birthweight PORT Research Activities attached as Appendix B. The Research Activities Table provides an annotated listing of the many practice reviews, secondary analyses, and decision analyses that the PORT has conducted. These studies are aimed at evaluating the effectiveness of various interventions in prevention of prematurity and fetal growth restriction, better defining risk factors associated with low birthweight, evaluating predictors and markers of preterm birth, and evaluating various obstetrical screening and treatment strategies. Many of the studies are also addressing variation in practice and cost of care issues. The findings from many of these analyses have informed the PORT's Antenatal Corticosteroid Dissemination Study and the Prenatal Intervention Trial.

The findings and practice recommendations from these studies are being disseminated through the usual routes via academic journals and professional publications and conferences. Most studies have already generated papers with practice recommendations that have been published in the major peer-reviewed journals. The references to these publications, manuscripts, and peer-reviewed abstracts and presentations are listed in the last column of the

Annotated Research Activities Table (Appendix B), and have been linked to the LBW PORT's Cumulative Bibliography so that the published findings and recommendations can be accessed. A copy of the complete cumulative bibliography is attached as Appendix C.

Major findings from these research activities are described in the Executive Summary. The ongoing practice reviews and secondary data analyses conducted by the LBW PORT have resulted in a large number of publications and practice recommendations which have been disseminated through the major peer-reviewed journals and at various professional meetings across the country. Target audiences have included obstetricians, pediatricians, clinician researchers, public health professionals, health services researchers, and other disciplines involved in practice, clinical policy, and research related to the care and/or outcomes of pregnant women at risk of delivering preterm/low birthweight babies. Table 6 illustrates the productivity of the LBW PORT and its program of research.

Table 6
Ongoing Dissemination Activities and Contributions:
LBW PORT Findings in the Literature

- Publication of over 100 peer-reviewed scientific articles and reviews (Including *NEJM*, *JAMA*, *Nature Medicine*, *AJOG*, *Ob/Gyn*, *Pediatrics*, *J Pediatrics*, *A J Public Health*, *JAMWA*)
- 4 prominent editorials
- 95 published research abstracts
- 11 book chapters and symposia

In addition to the publications and abstracts produced by the LBW PORT, the principal investigators have been invited to present PORT findings to professional organizations across the country and internationally. This has included special presentations of the LBW PORT and findings of strategies to prevent preterm birth and the relationship of infection and preterm birth to organizations involved in setting national research priorities. For example, LBW PORT principal investigators participated in four AHCPR-supported conferences in which they presented major findings from PORT research activities (including preliminary findings from the corticosteroid dissemination and prenatal intervention studies).

- Pharmaceutical Outcomes Research Group Meeting
  May 22, 1997; Rockville, MD
- The Effectiveness of Prenatal Care: New Evidence, New Paradigms
  June 26-27, 1997; Boston, MA
- Preterm Birth: Etiology, Mechanisms, and Prevention
  October 26-28, 1997; Charleston, SC
- Outcomes Research: Engine for Quality Improvement
  October 30-31, 1997; Washington, DC

C. Spinoffs: Ongoing Research and Implications for Future Research

As a result of the work begun under the research program of the LBW PORT, investigators are now involved in several innovative PORT spinoff projects and research trials aimed at the prevention of preterm low birthweight. These include:

- Smoke-Free Families Program Evaluation and Analysis
  Researchers evaluate the impact of 10 smoking cessation projects conducted under the Robert Wood Johnson Foundation's Smoke-Free Families Program which was influenced by early work conducted under the PORT.
- The Perinatal Emphasis Research Center (PERC) Studies
  The PERC will be studying approximately 5,000 rural women to determine the role of risk factors and underlying mechanisms in preterm delivery.
- The Association of Peridontal (Dental) Disease and Preterm Birth
  This study will try to establish a causal link between certain peridontal disease processes and increased risk of preterm birth.
- The NIH-Funded (RO1) Endometritis Study
  This study was funded to better determine the role of upper genital tract infection in spontaneous preterm birth and includes a randomized controlled trial component.

These studies will continue to examine the areas of research that seem most promising with respect to better understanding the role of infection in preterm birth and toward improving the effectiveness of smoking cessation interventions in pregnancy which may prevent a portion of low birthweight birth resulting from intrauterine fetal growth restriction.

Additional areas of continued research interest are described in the following sections.

IGP Five-Year Followup Data Set

The LBW PORT has access to the Small for Gestational Age and Infant Growth Project (IGP) 5-year followup data set which contains a wealth of information on IQ, developmental status, physical growth and environment for approximately 950 low birthweight children born to women who participated in the original IGP data set. This important data set will be utilized to look for associations between long-term outcome and certain maternal risk factors during pregnancy such as smoking, weight gain, nutritional status, and intendedness. This work will contribute to the continued development of a risk model that may help us better understand the maternal characteristics and risk factors that lead to better or worse long-term outcomes for low birthweight babies. The followup study analysis will allow investigators to determine more precisely the associations between SGA babies and their long-term neuro-developmental outcomes. Significant progress has already been made in this regard, and several findings are forthcoming that focus on nutritional factors and smoking in association with IQ, size, and certain neuro-behavioral outcomes. One preliminary analysis has already been published by the PORT from this data set looking at the relationship of being small for gestational age or preterm on intelligence at age 5 in a subset of 546 African American children.[49] This study found a small but significant decrease in the IQ for both groups of high-risk children and an increased risk of mental retardation for the small for gestational age group. The analysis also found that higher maternal language skills, positive home environment, and preschool attendance were associated with an improved mean IQ.

Maternal Magnesium Sulfate Administration and Improved Neonatal Outcomes

A proposal for a clinical trial to study the protective effects of $MgSO_4$ on the outcomes of ELBW babies (500-1,000 grams) initiated by LBW PORT investigators and colleagues from the NICHD-funded Maternal-Fetal Medicine Units (MFMU) Network was recently funded. The principal investigator on this trial, Dwight Rouse, M.D., has been a lead obstetrician investigator on the UAB PORT Obstetric Panel. His PORT-supported analysis looked at the feasibility of a randomized clinical trial on $MgSO_4$'s effect on cerebral palsy, using mortality and morbidity estimates from the literature to calculate sample size estimates.[94] In addition, a PORT-supported analysis by Hauth et al. provided confirmatory data to support recent evidence for the association of maternal administration of $MgSO_4$ with reduced risk of cerebral palsy. Thus, this trial will provide more definitive data about the use of $MgSO_4$ in the prevention of cerebral palsy.

Genital Tract Infections, Ethnicity, and Preterm Birth

One of the most important areas of interest for continued study by the PORT is bacterial vaginosis and various other clinical, biochemical, and biophysical markers for spontaneous preterm birth (SPTB). Members of the LBW PORT have published several papers and abstracts regarding genital tract infections associated with preterm birth. Data from a March of Dimes-supported randomized clinical trial of antibiotic treatment for bacterial vaginosis (BV) was used by PORT investigators to further explore the relationship of ethnic differences in the presence and treatment of bacterial vaginosis on the relative rates of preterm birth.[45] These findings were influential in convincing the NICHD to fund a MFMU Network trial to study bacterial vaginosis as a marker for preterm birth. Other papers involving LBW PORT investigators have looked at the association of bacterial vaginosis and the presence of fetal fibronectin in the vagina and found a strong association with SPTB. Through the PORT's access to several very good data sets, investigators are developing better risk-reduction models for exploring the association of these markers and risk factors with other more traditional risk factors (such as African American ethnicity, prior SPTB, and thinness).

Nutritional Supplementation, Prepregnancy Weight, and Weight Gain During Pregnancy

LBW PORT investigators have done extensive analysis in the areas of nutritional supplementation, prepregnancy weight, and weight gain during pregnancy. Again, the PORT has used its access to clinical trial data to conduct secondary analyses related to the association of zinc with increased birthweight for African American women, and women with additional risk factors for low birthweight related to pregnancy weight. The PORT has also used large prospective data sets to explore the relationships of zinc, folate, and other nutrients to preterm birth and low birthweight. In addition to studying the effects of nutritional supplementation, the PORT has used these large prospective data sets to test various hypotheses related to the influence of African American ethnicity, prepregnancy weight, and weight gain during pregnancy on preterm birth and intrauterine growth restriction. These analyses have informed the literature and highlighted the need for additional research.

Impact of Decentralization of Perinatal Services on Low Birthweight Outcomes

One of the PORT's subcontract relationships has stimulated further interest in the expanded California data set which has been used to explore the effects of perinatal center volume and level of care (regionalization) on neonatal outcomes using a risk-adjusted mortality index. This data set has also stimulated a second analysis collaborating with PORT neonatology investigators to explore the birthweight-specific mortality differences associated with patient volume and level of neonatal care. Also, with approval from AHCPR, the California data set study has been expanded to include an analysis of maternal factors leading to high-risk care and the association of these factors with pregnancy outcomes. The California investigators have set up a data set with clinically meaningful groups of maternal IDC-9 codes. This data set has been linked to prenatal care utilization data from the birth certificate. The data have been used to identify women who had conditions that would be considered high risk and whether those pregnancies resulted in an adverse outcome. Results of these analyses are forthcoming and have stimulated additional research questions regarding the effects of a competitive managed care environment on the high-risk care available to mothers and their newborns. In addition, the investigators have secured additional funding to add another year of linked data and hope to address these same types of questions by continuing to add additional years of linked data to build a longer time series for trend analysis.

Cost of Care by Gestational Age and Survival

The LBW PORT developed a computerized model to evaluate the short- and long-term neonatal outcomes and cost of lifetime medical care based on gestational age at birth.[122] This model will allow PORT investigators to further estimate improvement in outcomes and increases and decreases in cost of care by analyzing the expected outcomes of various obstetric and pediatric strategies/interventions which either postpone threatened preterm delivery or improve the survival of very preterm infants. The model is capable of differentiating the potential savings in long-term expenditures related to services for children with handicapping conditions resulting from extreme prematurity at birth (as well as the short-term savings in neonatal care).

Family Planning and Intendedness

Building on the preliminary work undertaken by the LBW PORT in Phases I and II, PORT investigators and colleagues have obtained some additional research support from the University of Alabama at Birmingham's Health Services Foundation General Endowment Fund to: (1) update the PORT's Phase I literature review; (2) perform additional secondary analysis of existing data sets; and (3) initiate surveys and focus groups for primary data collection to refine hypotheses and identify new researchable questions. Using this information in addition to information synthesized from funding agencies and nationally known family planning experts, the investigators will define the major researchable questions and issues related to family planning and unintended pregnancy. This effort will result in a larger scale multi-disciplinary funding proposal focused on family planning and intendedness using the LBW PORT's successful approach as a model.

Preliminary LBW PORT research in this area has also begun to influence the way data is collected and interpreted, and the way research issues and terms are defined at the national level. For example, a 1995 report by the Institute of Medicine's (IOM) Committee on Unintended Pregnancy, *The Best Intentions: Unintended Pregnancy and the Well-Being of Children and Families,* cites findings from a PORT analysis as support for the Committee's cautionary discussion that the labels and terms defining wantedness and intendedness as measured by the National Survey of Family Growth (NSFG) have limitations and ambiguities that should be seriously considered when interpreting this data. The LBW PORT's findings suggest that women's attitudes may shift from early to late pregnancy, so that an initially unintended pregnancy can result in a much-wanted child.[116] The IOM emphasizes these distinctions between mistimed and unwanted pregnancies in its discussion of the survey.

D. Summary Implications, Findings, and Conclusions

Summary Implications

The LBW PORT has made significant progress in studying the practices aimed at the prevention of low birthweight and its major sequelae. The findings from PORT practice investigations have informed the professional literature and provided the groundwork for recommendations regarding practices that remain in question as to their benefits and/or risks.

In addition to publication in the professional literature, the LBW PORT's findings have influenced practice recommendations disseminated by the Centers for Disease Control (CDC) and the National Institutes of Health (NIH). Findings from a PORT decision analysis on the cost effectiveness of maternal screening and treatment strategies for the prevention of neonatal group B streptococcal sepsis were used by the CDC in formulating recently released screening and treatment recommendations. The PORT also participated extensively in the NIH Consensus Development Conference on the Effect of Corticosteroids for Fetal Maturation on Perinatal Outcomes, held February 28-March 2, 1994. We presented findings that influenced the NIH's recommendations for use and have collaborated to develop strategies to enhance corticosteroid use.

In the arena of health care organization and delivery, a LBW PORT-supported analysis of the effects of perinatal center volume and level of care on neonatal mortality has received the attention of the professional community, the managed care community and its counterparts, the national media, and State-level policymakers. The analysis utilizes a large California data set linking infant birth/death certificate data for 1990 with hospital discharge data from levels I, II, II+, and III perinatal centers in the State. Findings from this analysis indicate that the deregionalization of perinatal services that occurred as a result of California's competitive contracting and managed care environment had a negative impact on neonatal mortality in the State. The results of this analysis were published in a special managed care edition of *JAMA* in October 1996.

Finally, utilizing our findings from the first 2 years of the PORT, we implemented two large-scale intervention projects. The implementation of these large-scale intervention studies demonstrates the LBW PORT team's ability to synthesize the information available to us and to use that information to design comprehensive targeted interventions. What we have learned from the Antenatal Corticosteroid Dissemination Study will inform the literature on the effectiveness of disseminations targeted at changing physician practice behavior (thereby adding to the clinical decisionmaking literature). By implementing a national 27-site dissemination study that increased corticosteroid use in study hospitals over and above that of the Consensus Conference, the LBW PORT demonstrated that, under the right conditions, a well-designed dissemination effort can improve the adoption of national practice recommendations and guidelines. In fact, the dissemination study has already attracted the attention of a large national managed care network, influencing it to initiate its own project aimed at increasing the appropriate use of corticosteroids by participating obstetricians. Recently, United HealthCare approached the LBW PORT team for permission to model components of the corticosteroid dissemination study in their Antenatal Corticosteroid Project.

Similarly, what we have learned from the Prenatal Intervention Trial (Mother and Family Specialty Center) demonstrated more clearly than ever before that prenatal care by itself, even when it is of high quality and provided in a culturally supportive and risk-targeted manner, *will not* be a major factor in reducing rates of low birthweight among children born to low-income African American women. However, the findings also support the value of prenatal care for helping low-income minority women become more knowledgeable about their pregnancies and risk factors and can contribute to positive maternal behavior change such as smoking cessation during pregnancy. The findings from this intervention study, combined with many other findings from the PORT, should stimulate considerable discussion at the national, State, and local levels regarding how to best impact low birthweight outcomes.

Summary Findings and Conclusions

Despite the utilization of ever-increasing amounts of research and clinical care resources aimed at achieving prevention or reduction, there is very little evidence to date that any intervention or practice has had a major impact. Neither medical/obstetrical strategies nor behavioral approaches (smoking or drug cessation programs, nutritional counseling or supplementation, provision of culturally appropriate and supportive prenatal care, etc.) in practice today, have had a significant impact on the rate of preterm birth.[40] However, we are optimistic that what has been learned over the past 5½ years by the LBW PORT and others in the areas of infection and preterm birth, will move the field forward with respect to reducing the rate of prematurity and low birthweight and its major sequelae. [2,56,61,109]

Research priorities need to be concentrated in the continued search for factors that explain the specific causes (etiologies) of spontaneous preterm birth such as infection in the lower and upper reproductive tract, and in the continued funding of carefully designed trials of new practices that have strong theoretical potential to reduce the rate of low birthweight and prematurity. Of equal importance are studies that aim to more effectively or extensively to utilize practices that have been proven effective, such as the activity which occurred around improving the use of antenatal corticosteroids in preterm delivery, and the dissemination of recommendations regarding the most effective screening and treatment strategies for maternal group B streptococcal infection.

In addition, until we have more effective strategies to prevent both preterm and term low birthweight, it is critical that we continue to ensure that those low birthweight infants who are born survive free of major long-term disability to the greatest degree possible. This includes assuring that premature newborns are born in perinatal centers with level III-designated NICUs. It also includes gaining a better understanding how low birthweight infants do as they grow and develop. To date, most evidence suggests that very low birthweight infants are more at risk for long-term neurological and developmental problems; therefore, using longitudinal databases that include maternal and pregnancy-related characteristics linked to infant outcomes and child development measures will allow us to better understand the determinants of these poorer long-term outcomes (and will help in the effort to develop better early intervention programs after birth). Through the work of the LBW PORT, investigators plan to continue preliminary work in this area.

Much of the LBW PORT's research has stimulated additional research and posed further questions about the causes of prematurity and low birthweight. The practice evaluations and secondary data analyses conducted under the LBW PORT's program of research have reaffirmed many of the investigators' original hypotheses about the lack of effectiveness of most interventions used in practice today with respect to the prevention of low birthweight, further convincing us that there is a need for better understanding of the determinants of preterm birth in all ethnicities, but especially in African American women.

To this end, the Principal Investigator and others will continue the course of research developed during this PORT in the areas of infection and preterm, the development of better makers/predictors of preterm birth, and the development of more targeted and therefore more effective interventions based on our improved understanding of the various risk factors for low birthweight and causes of preterm birth.

APPENDIX A

Low-Birthweight PORT Participating Investigators and National Advisory Panel Members

Low-Birthweight Port

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APPENDIX B

Annotated Research Activities Table

An Annotated Table of Practice Reviews and Secondary Data Analyses Linked to the LBW PORT's Cumulative Bibliography

Low-Birthweight PORT

Research Activities

(An Annotated Table of Practice Reviews and Secondary Data Analyses Linked to the LBW PORT's Cumulative Bibliography)

STUDY	*INVESTIGATORS**	*TYPE OF ANALYSIS/REVIEW*	*REFERENCES*
PERINATAL REGIONALIZATION			
Series of Regionalization Papers from Expanded California Dataset: *1) Impact of Perinatal Center Volume and Level of Care on LBW Infant Outcome* *2) Impact of Payer Source on Neonatal Mortality* *3) Study of the Influence of Gestational Age, Birthweight, and Other Neonatal Characteristics on Mortality by Level of Care*	*C. Phibbs (PAIRE)* *J. Bronstein* *R. Phibbs (Stanford)* *E. Buxton (PAIRE)* *W. Carlo* *J. Cifuentes*	*A series of secondary analyses using data from California hospital discharge data linked to birth/death certificate data for 1990. This analysis applies a risk-adjusted logistic regression model.*	87, 123,126, 173, 174, 249, 250, 251, 252, 253
Role of Maternal Characteristics in Perinatal Regionalization and Access to Neonatal Intensive Care	*J. Bronstein* *E. Capilouto*	*Multivariate analysis of Alabama vital statistics records for infants weighing 500 to 1,499 grams.*	12
Effectiveness of Prenatal Care Referral System for High-Risk Women and Association of High-Risk Conditions with Adverse Outcomes	*C. Phibbs (PAIRE)* *J. Bronstein* *J. Ecker (UCSF)*	*Creation of analytic database aggregating ICD-9 codes into clinically meaningful groups for secondary analysis of expanded California dataset.*	*In Manuscript*
PRACTICE VARIATION STUDIES			
Practice Variation in Antenatal Hospital Admissions and Treatment Strategies Associated with Preterm Labor	*J. Bronstein* *R. Schwartz (NPIC)*	*Model of variation across practice sites, maternal characteristics, and hospitalizations.*	*In Manuscript*
Modeling Practice Variation in the Use of Obstetrical Interventions in High-Risk Pregnancies: Use of Tocolysis and Antenatal Corticosteroid Therapy in Preterm Labor	*J. Bronstein* *R. Goldenberg* *S. Cliver*	*Use of MOD dataset to model provider & system-level care variations in treatment of high-risk pregnancies & deliveries.*	14

Determinants of Variation in Use of Corticosteroids to Improve Outcomes in Preterm Birth	*J. Bronstein* *R. Goldenberg* *S. Cliver* *L. Wright (NICHD)* *G. Cutter*	*Results of a comparison of 8 large multi-center datasets to assess factors consistently associated with use of steroids in preterm labor.*	*13, 172*
Exploration of Physician Opinion and Practice Affecting Low Use of Corticosteroids	*L. Leviton* *S. Baker* *A. Hassol* *R. Goldenberg*	*Analysis of a series of key informant interviews with academic obstetricians and neonatologists and a series of focus groups with community obstetricians.*	*74*
Physicians' Opinions of Survival of VLBW Infants and Use of Corticosteroids	*M. Gardner* *J. Bronstein* *J. Haywood* *R. Goldenberg* *S. Cliver* *K. Nelson*	*Secondary analysis of two surveys of Alabama physicians, 1979 and 1992. Both surveys targeted obstetricians and family physicians who provided maternity care in Alabama.*	*34 66*
ANTENATAL SCREENING AND TREATMENT STRATEGIES			
Use of Decision Analysis in Obstetrics and Gynecology: A Clinical Perspective	*D. Rouse* *J. Owen*	*Review of the application of decision-analytic modeling in obstetrics and gynecology.*	*117, 139*
Decision Model to Estimate the Potential Effectiveness and Monetary Costs of Elective C-Sections for Fetal Macrosomia Diagnosed by Ultrasound	*D. Rouse* *J. Owen* *R. Goldenberg* *S. Cliver*	*Decision analytic model using probability estimates from the literature supplemented by data from the Collaborative Trial of Preterm Birth Prevention (MOD dataset). Costs were estimated from the literature, regional estimates, and clinical practice data.*	*95*
A Decision Analysis to Quantitate the Risks and Benefits of Maternal-Neonatal Zidovudine Administration to Prevent Vertical HIV Transmission	*D. Rouse* *J. Owen* *R. Goldenberg* *S. Vermund*	*Development of a decision analytic model using probability estimates of infection, death, and adverse outcomes derived from the AIDS Clinical Trials Group Study.*	*91, 258*
A Decision Analysis Comparing the Cost-Effectiveness/Cost-Benefit of Three Strategies for the Management of the Varicella-Exposed Pregnant Woman	*D. Rouse* *M. Gardner*	*Cost-effectiveness/cost-benefit analysis using baseline assumptions of outcomes derived from the literature.*	*93, 259*

Analysis of Strategies for Prevention of Early Onset Group B Strep Sepsis	*D. Rouse* *C. Fargason* *S. Cliver* *R. Goldenberg* *S. Mennemeyer*	*Decision-analytic model to better understand the implications of 19 screening and treatment strategies on the presentation of early onset GBS sepsis.*	*89, 257*
Routine Use of Maternal Platelet Count to Screen for Thrombocytopenia	*D. Rouse* *J. Owen* *R. Goldenberg*	*A systematic review and critical evaluation of the evidence for effectiveness of the use of a screening technology.*	*118*
Antenatal Screening for Factor V Leiden Mutation in Asymptomatic Pregnant Patients	*D. Rouse* *R. Goldenberg* *K. Wenstrom*	*A critical review of the literature to evaluate the evidence for routine screening of asymptomatic pregnant women for thrombolytic disease.*	*97*
Decision Model of the Impact of Antenatal Screening and Treatment Strategies for Group B Strep on Pediatric Treatment of LBW Infants	*D. Rouse* *C. Fargason* *M. Peralta* *S. Cliver* *J. Gigante (Vanderbilt)* *G. Cutter*	*1) Use of data from two surveys of pediatricians to expand a decision analytic model on the impact of OB screening & treatment strategies on pediatric practices.* *2) Cost estimates.* *3) Final model combined with obstetric decision model.*	*85*, 24, 124, *184, 196, 197*
Pregnant Women's Preferences for Two Strategies to Reduce Group B Strep Infection in Neonates	*M. Peralta* *C. Fargason*	*Analysis of data from a structured interview that employed an interactive computer-based decision-making model called the Analytic Hierarchy Program (AHP).*	86, *243, 244*
Decision Analysis of the Optimal Time During Gestation to Initiate Antenatal Fetal Testing (Tests for Fetal Well-Being)	*D. Rouse* *J. Owen* *R. Goldenberg* *S. Cliver*	*Decision model incorporating the following components:* *Test sensitivity/specificity and week-specificity probability estimates for fetal death, early delivery, and neonatal morbidity and mortality.*	*92*
Cost-Benefit Comparisons of Screening and Treatment Strategies for Vaginal and Urinary Tract Infections During Pregnancy	*D. Rouse* *W. Andrews* *R. Goldenberg* *J. Owen*	*Development of a decision analytic model using probability estimates derived from the literature. Cost estimates were based on a survey of local pharmacies and laboratories supplemented by estimates from the literature.*	*89*

Prophylactic Cesarean Delivery for Prenatally Diagnosed Malformations	*J. Owen*	*A critical review of the evidence from the literature.*	*114*
Relationship of Amniocentesis to Mid-Trimester Spontaneous Pregnancy Loss in High-Risk Women	*R. Davis* *J. Owen* *K. Wenstrom* *M. DuBard*	*Secondary analysis on 8,807 women referred for genetic screening from 1989-1994 for mid-trimester (14-22 weeks) counseling using the UAB Genetics database.*	180, 181, 182, 183
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The Effectiveness of Treatment with Metronidazole and Erythromycin in Reducing the Incidence of Preterm Delivery in Women with Bacterial Vaginosis	*J. Hauth* *R. Goldenberg* *W. Andrews* *M. DuBard* *R. Copper*	*Results of primary and sub-analyses of double-blind randomized trial of M+E treatment of women identified as at risk of preterm delivery.*	*60, 212*
The Association of Sexually Transmitted Diseases with Adverse Pregnancy Outcomes	*R. Goldenberg* *W. Andrews* *A. Yuan* *T. McKay (CDC)* *M. St. Louis (CDC)*	*Review and synthesis of the literature.*	51, 131
The Role of Upper and Lower Genital Tract Infections in Spontaneous Preterm Delivery: *1) Intrauterine Infection and Preterm Prevention* *2) Association of Predictive Markers and Effectiveness of Treatment Strategies* *3) Differences Among Ethnic Groups in Vaginal pH and the Relationship to Bacterial Vaginosis and Preterm Delivery* *1) Association of Various Risk Factors for STDs with Bacterial Vaginosis in Different Ethnic Groups*	*W. Andrews* *J. Hauth* *R. Goldenberg* *M. DuBard* *R. Copper* *A. Goepfert* *M. Klebanoff (NICHD)* *R. Nugent (NICHD)*	*1) Comprehensive literature review and comment.* *2) Secondary data analysis of M+E clinical trial data.* *3) Secondary analysis of M+E clinical trial data.* *1) Multiple regression analysis using VIP dataset to determine association of STD risk factors with BV in different ethnic groups.*	*2, 45, 46, 160,* 198, *203, 211*

Effectiveness of Tests to Detect Genitourinary Tract Infection During Pregnancy *1) Detection of Chlamydia Trachomatis*	*W. Andrews*	*1) Analysis of the results of ligase chain reaction tests of cervical swab and urine cultures versus assessment by cervical culture. Cultures were obtained for 462 women obtaining routine prenatal care.*	3, *161*
Antenatal Asymptomatic Colonization of the Chorioamnion by Ureaplasma: Association with Post-Cesarean Endometritis	*W. Andrews* *J. Hauth* *R. Goldenberg* *G. Cassell*	*Analysis of cultures taken at cesarean delivery on 575 women in a study of post-cesarean endometritis.*	*1, 159*
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The Relationship Between Tocolytic Therapy, Use of Corticosteroids, and Morbidity and Mortality in VLBW Infants	*W. Atkinson* *R. Goldenberg* *F. Gaudier* *S. Cliver* *K. Nelson* *J. Hauth* *I. Merkatz (Einstein)*	*1) Retrospective review of birth logs and OBAR (1979-1991) for VLBW infants (500-1,000 grams) to create a database including prenatal, L&D, newborn, and followup data (UAB ELBW dataset).* *2) Secondary analysis of data on 915 infants from a large retrospective multi-center study of live-born infants weighing less than 1,500 grams at delivery (UAC Trial dataset).*	*6*, 121, *162*, *163*,
Steroid Use Combined with Tocolytic Therapy in the Prevention of IVH: Review of Tennessee Linked Data Set	*J. Piper (Vanderbilt)* *W. Atkinson* *E. Mitchell (Vanderbilt)* *R. Goldenberg* *S. Cliver*	*Secondary analysis comparing outcomes using the Tennessee dataset. The Tennessee dataset has been birth/death certificate linked and subsequently linked to a sample of abstracted hospital records. It consists of linked data on all infants born in Tennessee in 1989 and 1990 for which hospital records could be obtained (1,729 neonates).*	88, *254*
Use of Antenatal Corticosteroids in Special Populations and Circumstances: *1) The Benefits of Antenatal Corticosteroid Therapy in the VLBW Infant* *2) Clinical Use of Corticosteroids*	*J. Maher* *R. Goldenberg* *S. Cliver* *R. Davis* *R. Copper* *M. Gardner*	*Secondary analysis of data from the MOD Prematurity Prevention Project (MOD dataset).*	*30*, 35, *75*, *77*, *272*, 234

Effects of Corticosteroids on Apgar Scores of ELBW Babies	*M. Gardner* *R. Goldenberg* *F. Gaudier* *K. Nelson* *J. Hauth*	*Secondary analysis using the UAB ELBW dataset.*	*27, 187*
Benefits of Antenatal Corticosteroid Therapy Versus Risk of Neonatal Sepsis in 24-32 Weeks' GA with PPROM	*M. Gardner* *D. Rouse* *R. Goldenberg*	*Decision analysis using estimates from the literature to derive baseline assumptions of adverse outcomes.*	*Unpublished abstract*
RISK FACTORS FOR PREMATURITY AND FETAL GROWTH RESTRICTION			
Low Birthweight, Preterm Delivery, and Fetal Growth Retardation in Low-Income Black and White Women: Relationship of Medical, Psychosocial, and Behavioral Risk Factors	*R. Goldenberg* *S. Cliver* *F. Mulvihill* *C. Hickey* *H. Hoffman (NIH)* *L. Klerman*	*Use of the IGP/SGA dataset to examine the risk factors associated with preterm LBW and FGR in a low income population of pregnant women to determine whether these risk factors explain the differences in LBW outcomes between black and white women.*	*47*
Factors Associated with Preterm Delivery in Multiparous Women: A Review of Consecutive Pregnancies	*S. Cliver* *S. McNeal* *R. Goldenberg* *L. Klerman*	*Using the SGA/IGP dataset, simple and multiple regression analyses were performed on 1,098 women with consecutive singleton deliveries.*	*Unpublished abstract*
Influence of Race/Ethnicity and Previous Pregnancy Outcome on Outcomes in Current Pregnancy	*M. Gardner* *R. Goldenberg*	*Literature review.*	*29*
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Determinants of Poor Pregnancy Outcomes Among Teenagers	*P. Olausson (Sweden)* *S. Cnattingius (Sweden)* *R. Goldenberg*	*Analysis using data from linked data from the Swedish Medical Birth Registry and the Swedish Population Census for 1990-1991 for singleton births to women <25 years of age.*	84

Relationship of Psychosocial Status to Preterm delivery in Multiparous Women	S. Cliver R. Goldenberg C. Hickey H. Hoffman (NIH) R. Copper	Secondary analysis of data from the SGA/IGP dataset.	176
Risk Factors and Predictors for Fetal Growth Restriction: Serum Leptin Concentrations During Pregnancy	R. Goldenberg S. Cliver T.Tamura	Secondary analysis of data from the SGA/IGP dataset on stored serum samples taken at 19,26, 30 and 36 weeks' GA. This sample includes 135 women who delivered full-term.	105, 178
Risk Scoring for Birth Outcomes	G. Cutter R. Goldenberg H. Hoffman (NIH) S. Cliver	Secondary analysis of the SGA/IGP data to test the correlation between pregnancy outcomes and 11 risk factors used in screening the study population.	Unpublished manuscript
Neonatal Consequences of Preeclampsia by Maternal Risk Factors	R. Goldenberg S. Cliver D. Rouse J. Hauth	Secondary Analysis of MOD dataset.	199
Twins and Preterm Birth Outcomes	M. Gardner R. Goldenberg	Secondary analysis using the MOD dataset (432 twin deliveries) and the UAB ELBW dataset to compare characteristics of preterm twin births to singleton preterm births.	28, 186
Risk Factors for Early Fetal Death	R. Copper R. Goldenberg M. DuBard R. Davis	Secondary analysis using MOD dataset looking at demographic, obstetric, and medical risk factors.	19
Asthma in Pregnancy	C. Chazotte (Einstein)	Literature review on the association of asthma and its management in pregnancy with preterm delivery.	15

NEONATAL OUTCOMES AND SEQUELAE			
The Effect of Surfactant Administration to Neonates on the Incidence of Bronchopulmonary Dysplasia (BPD)	J. Cifuentes W. Carlo G. Mariani E. Zola B. Mitchell	This secondary analysis used data from the neonates enrolled in the Survanta Trials originally reported in 1991 by Hoekstra, et al. The analysis employs logistic regression models using pretreatment variables reported to be associated with mortality to compare the outcomes of the placebo group to the surfactant treated group.	175
1) The Protective Effect of Maternal $MgSO_4$ on Development of Cerebral Palsy in the ELBW Births 2) Investigation of $MgSO_4$ Effects on Reducing Cerebral Palsy in Preterm Neonates: Feasibility of a Randomized Clinical Trial 3) Preterm Birth, Cerebral Palsy, and Magnesium	J. Hauth R. Goldenberg K. Nelson M. Peralta F. Gaudier M. DuBard D. Rouse	1) Analysis of a prospective dataset on all ELBW (500-1000 gm) infants born at UAB from 1979 and 1991. Maternal, infant and >1 year followup data were collected 2) Literature review and preliminary secondary analysis of existing datasets were used to derive estimates for this analysis 3) Review of the literature on protective effects of $MgSO_4$ on PTD and CP	50, 94, 213
Neonatal Outcomes Associated with the Use of Indomethacin as a Tocolytic Agent to Prevent PTD	M. Gardner J. Owen	Analysis of data from a retrospective case-control study of singleton infants 24-32 weeks' gestation.	32, 189
Cerebral Palsy and Other Neurodevelopmental Outcomes Associated with PTD and IUGR	R. Goldenberg K. Nelson H. Hoffman S. Cliver	Literature review.	57, 134
Neonatal Outcomes in Very Preterm Births: The Effects of PPROM versus Preeclampsia as Complications of PTD	F. Gaudier R. Goldenberg J. Hauth M. DuBard K. Nelson	Secondary analysis of UAB OBAR data.	193
Comparison of Use of Apgar Scores to Use of Acid-Base Status for Determining Outcomes in VLBW Deliveries	F. Gaudier R. Goldenberg K. Nelson	Retrospective chart review and analysis of OBAR data on 1,115 ELBW infants (500-1,000 grams).	38, 195

Comparison of Acid-Base Status at Birth in SGA Versus AGA Infants < 1,000 Grams and Association of Acid-Base Status to Subsequent Neurosensory Impairment in VLBW Infants at > 1 Year	*F. Gaudier* *R. Goldenberg* *K. Nelson* *M. Peralta* *S. Johnson* *J. Hauth*	*Retrospective chart review and analysis of OBAR data on 289 ELBW infants (500-1,000 grams).*	*37, 192*
Cost of Care by GA for Premature Infants	*E. Barefield* *K. Nelson* *S. Cliver* *R. Goldenberg*	*1) Cost model by week of GA and survival.*	122, *164, 165, 166, 167*
Changes in Survival and Long-Term Neurologic Outcomes of Infants 23-27 Weeks: 1979-1985 and 1986-1991	*F. Gaudier* *M. Peralta* *R. Goldenberg* *K. Nelson* *M. DuBard* *S. Johnson*	*Secondary analysis of UAB OBAR data for two different time periods.*	*194,* 242
Relationship of Perinatal Mortality Rates to Reporting of Low Birthweight	*S. Phelan* *R. Goldenberg* *G. Alexander* *S. Cliver*	*Analysis of linked live birth, infant death, and fetal death records from Alabama vital statistics data for selected years from 1974-1994 to determine if the slow improvement in the state's neonatal mortality rates is a result of increased reporting of extremely LBW infants.*	115
Definitions and Standards for Small for Gestational Age (SGA) versus Intrauterine Growth Restriction (IUGR)	*R. Goldenberg* *S. Cliver*	*A review and synthesis of the literature dealing with the definitions of the related terms IUGR/FGR and SGA.*	55
The Effects of Early Intervention on LBW, Premature Infants' Intellectual Development	*C. Blair* *C. Ramey* *M. Hardin*	*Secondary analysis of the 8-site Infant Health and Development Program (IHDP) dataset to examine the relationship of early intervention and intellectual development longitudinally, including multivariate analyses of intervention modalities and child/family characteristics.*	*9, 169, 170*

Early Intervention for Low-Birthweight Infants and Children with Other High-Risk Conditions	*C. Ramey* *S. Ramey* *D. Shearer* *C. Blair*	*1) A literature synthesis of randomized controlled trials of early intervention for LBW infants conducted since 1986* *2) A review of the development of early intervention science as it relates to children with disabilities and high-risk conditions* *3) A review of the state of the science and conceptual framework*	*129*, 137, 138
Risk Status Associated with IQ in High-Risk LBW Premature Infants	*C. Blair* *C. Ramey*	*Secondary analysis of 8-site IHDP dataset using multiple regression techniques to examine how level of participation effects the intellectual development of children by risk status.*	*168, 171*
Extremely Low-Birthweight Infants: Health, Growth, and Achievement in Adolescence	*M. Peralta* *K. Nelson* *S. Johnson* *C. Ashworth*	*Analysis of a survey of ELBW babies admitted to UAB's Neonatal Intensive Care Unit between 1976 and 1981 and followed by UAB's Newborn Followup Clinic.*	*237*, 245, 246, 247, 248
Relationship of Maternal and Neonatal Characteristics to Major Handicap at > 1 year of age	*R. Goldenberg* *F. Gaudier* *K. Nelson* *M. Peralta*	*Secondary analysis of 403 ELBW infants born at UAB from 1979-1981 who received neuro-developmental followup at >1 year of age.*	*200*
Association Between Pregnancy Outcome, Growth, and Development (Physical and Intellectual) at Ages <1 and 5 *1) Association Between Pregnancy Outcome and Intelligence at Age 5 for SGA Infants* *2) Growth and Development During the First Year of Life for Low-Income SGA Term-Born Infants*	*R. Goldenberg* *K. Nelson* *M. DuBard* *S. Cliver* *K. Blankson* *S. Ramey* *T. Herman (NIH)* *H. Hoffman (NIII)* *M. Gardner*	*1) Secondary analysis of SGA/IGP 5-year followup dataset for women delivering a small for gestational age baby or who had a preterm delivery combined with a followup IQ test at 5.5 years of age (includes 459 children of low-income black mothers)* *2) Secondary analysis of SGA/IGP 1-year followup data on a cohort of 717 of 949 low-income term-born infants whose mothers were followed over the first year of the infants life*	*49, 83*, ***201***, 191

Perceptions of Neonatal Nurses and the Impact on LBW Infant's Outcomes	S. Johnson J. Haywood K. Nelson R. Goldenberg G. Cutter	Analysis of mail survey of a sample of pediatric nurses working in neonatal intensive care (NICU) settings across the country.	227, 228
Obstetricians' and Pediatricians' Perceptions of Viability of VLBW Infants and Relationship to Treatment Decisions Such As the Use of Antenatal Corticosteroid	J. Haywood J. Bronstein R. Goldenberg W. Carlo S. Morse K. Nelson M. Gardner S. Cliver	1) Analysis of survey results to compare obstetricians' and pediatricians' perceptions of viability: Responses to a series of state and national surveys are compared to national estimates of morbidity and mortality 2) Secondary analysis of Alabama survey data looking at opinions on antenatal corticosteroid use	62, 112, 214, 215, 216, 217, 218, 219, 220
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Prepregnancy Weight and Pregnancy Outcomes: Review of the Relationship to Various Behavioral and Nutritional Issues	T. Tamura R. Goldenberg	Summary review of secondary data analysis done by PORT investigators to explain the relationship of both high and low prepregnancy weight to poor pregnancy outcomes.	64
Psychosocial Determinants of Low Prenatal Weight Gain in Non-Obese Black and White Women	C. Hickey S. Cliver	Secondary analysis using SGA/IGP dataset focusing on data obtained from a 72-item questionnaire and interview conducted at the first prenatal visit.	66, 69, 223
Prenatal Weight Gain and Weight Gain Patterns and Fetal Growth Retardation: 1) Among High-Risk Multiparous Black and White Women 2) Among Non-Obese Black and White Women	C. Hickey S. Cliver R. Goldenberg J. Kohatsu H. Hoffman (NIH) S. McNeal	Secondary analysis using SGA/IGP dataset.	63, 67, 225
Prenatal Weight Gain and Spontaneous Preterm Delivery Among Non-Obese Black and White Women	C. Hickey S. Cliver H. Hoffman (NIH) R. Goldenberg	Secondary analysis using SGA/IGP study dataset.	64, 222
Sociodemographic Risk Factors for Low Prenatal Weight Gain	C. Hickey S. Cliver R. Goldenberg H. Hoffman (NIH)	Secondary analysis using SGA/IGP study data.	224

Effect of Maternal Attitude on Prenatal Weight Gain and LBW	R. Copper M. DuBard R. Goldenberg	Secondary analysis of SGA/IGP study data.	21
Examination of Low Prepregnancy Body-Mass Index as a Risk Factor for Spontaneous Preterm Birth and Variation by Ethnic Group	C. Hickey S. Cliver R. Goldenberg S. McNeal	Secondary analysis using MOD dataset.	68, 226
Provider Practice Variation in Response to Low Prenatal Weight Gain Among Women with Low and Average Pregnancy Weight	C. Hickey J. Bronstein S. Cliver	1) Phase I literature review.	Unpublished manuscript
Relationship of Zinc, Folate, and other Vitamins to Pregnancy Outcome	R. Goldenberg Y. Neggers T. Tamura H. Hoffman (NIH) J. Hauth M. DuBard R. Copper	1) Analysis of lab values from blood samples taken during the SGA/IGP study 2) Secondary analysis of data recently made available from a randomized trial of zinc supplementation during pregnancy	43, 80, 81, 82, 99, 100, 103, 202, 235
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Relationship Between Maternal Characteristics and Fetal and Neonatal Anthropometric Measurements to Birthweight	Y. Neggers R. Goldenberg S. Cliver H. Hoffman (NIH) G. Cutter	1) Secondary analysis of SGA/IGP dataset to determine which maternal weight measurements best predict infant size at birth 2) A summary of findings from several secondary analyses using SGA/IGP dataset	79, 53
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Relationship of Angiotensin-Converting Enzyme Genotypes to Plasma Zinc Concentrations, Preeclampsia, and Pregnancy Outcome	T. Tamura R. Goldenberg G. Johanning K. Johnston M. DuBard	Secondary analysis of clinical trial data from the randomized trial of zinc supplementation in pregnancy using a sample of 191 African-American pregnant women.	102

Decision Model on Low-Dose Aspirin Treatment for Prevention of Preeclampsia	D. Rouse R. Goldenberg S. Cliver	Estimates from risk factors for preeclampsia by parity will be used to construct a decision model: 1) Secondary analysis of MOD data for risk estimates 2) Decision Model using secondary analysis of UAB LDA trial data	177 Unpublished abstract
Maternal Serum Thromboxane B_2 Reduction and Pregnancy Outcome in a Low-Dose Aspirin Trial	J. Hauth R. Goldenberg C. Parker G. Cutter R. Copper	Secondary analysis of serum samples from LDA trial dataset on 606 pregnant women.	59
The Effect of LDA Therapy on the Development of Preeclampsia in Women with Elevated hCG	K. Wenstrom J. Hauth R. Goldenberg M. DuBard	Secondary analysis of lab values obtained from women screened for participation in LDA trial dataset.	106, 266
Safety of Low-Dose Aspirin Therapy for the Prevention of Preeclampsia: Association with Placental Abruption	J. Hauth R. Goldenberg C. Parker G. Cutter S. Cliver	Meta-analysis of published prospective and double-blind randomized trials of low-dose aspirin therapy to investigate a possible association with abruptio placentae.	58
Effect of Maternal Size on Fetal Growth for Women Using LDA for the Prevention of Preeclampsia	R. Goldenberg J. Hauth M. DuBard R. Copper G. Cutter	Secondary analysis of ultrasound data for measuring fetal size and gestational age in pregnant women enrolled in the LDA trial dataset.	41
Use of $MgSO_4$ To Control Seizures in Pregnancy Associated Hypertension: The Impact on Labor Induction	W. Atkinson D. Guinn J. Owen J. Hauth	Prospective review of women randomized to receive $MgSO_4$ or another seizure control agent.	7
OBSTETRIC STRATEGIES TO PREVENT PTB, LBW, AND OTHER POOR PREGNANCY OUTCOMES			
Prevention of Low Birthweight and its Sequelae: The State of the Science	R. Goldenberg W. Atkinson J. Bronstein	Reviews of the literature and state of the science of prevention of low birthweight and its major sequelae.	4, 40, 109, 132

Effectiveness of Bedrest as a Treatment Strategy to Prevent Preterm Delivery and Treat Related Conditions	*R. Goldenberg* *S. Cliver* *J. Bronstein* *G. Cutter* *W. Andrews* *S. Mennemeyer*	*1) Literature review* *2) Secondary data analysis using 1988 National Infant Mortality Survey*	*39*
IV Hydration Use in Preterm Contractions	*M. Freda (Einstein)* *N. Devore (Einstein)*	*Literature review.*	*26*
Evaluation of Maintenance Terbutiline Pump Therapy to Prevent PTD	*D. Guinn* *A. Goepfert* *K. Wenstrom* *J. Hauth*	*Analysis of data from a randomized controlled trial of pregnant women with documented PTL at <34 weeks' GA.*	210
Oxytocin Augmentation for Active Phase Labor Arrest and Pregnancy Outcome	*D. Rouse* *J. Owen* *J. Hauth*	*Prospective evaluation of the use of an oxytocin augmentation protocol for active phase labor arrest. Data were collected and charts reviewed for 332 women managed by the protocol.*	262
Intrapartum Epidural Analgesia and Pregnancy Outcome	*D. Rouse* *J. Owen* *J. Hauth* *J. Loncar* *M. DuBard*	*Retrospective analysis of 7,315 deliveries occuring at one hospital between January 1994 and December 1996. Patients were identified from the OBAR database. Inclusion criteria: singleton vertex births, GA >24 weeks, Bwt. >500 grams, and either spontaneous, augmented, or induced labor.*	263
Cost Comparison of Induction of Labor vs. Expectant Management in Post-Term Pregnancies	*M. Gardner* *D. Rouse* *R. Goldenberg* *J. Lanning*	*Cost analysis of three different obstetric management strategies examined in the Maternal-Fetal Medicine Unit's Post-Term Trial.*	33
Twins, Bedrest, and Preterm Delivery	*B. Andrews* *M. Smith*	*1) Literature review* *2) Proposed meta-analysis*	*Unpublished abstract*
BIOPHYSICAL AND BIOCHEMICAL MAKERS/PREDICTORS OF PRETERM DELIVERY			
Markers of Preterm Birth: A Review of the State of the Science	*R. Goldenberg* *W. Andrews* *J. Hauth*	*Literature review.*	*56*

Examination of the Relationship of Psychosocial and Physiologic Factors to Preterm Delivery	*R. Goldenberg* *S. Cliver* *C. Hickey* *L. Klerman*	*Secondary analysis of existing datasets to determine their usefulness in exploring these relationships and to develop better tools for measuring them.*	273, *274*
Abbreviated Psychosocial Scale for Assessing Risk of LBW	*R. Goldenberg* *C. Hickey* *S. Cliver*	*Development and evaluation of a condensed psychosocial scale for assessing psychosocial risk for LBW.*	54
SUBSTANCE ABUSE AND OTHER MATERNAL HIGH-RISK BEHAVIORS			
Effects of Prenatal Care and Substance-Abuse Treatment on LBW Outcomes for Pregnant Cocaine and Opiate Abusers	*C. Chazotte (Einstein)* *J. Youchah (Einstein)* *M. Freda (Einstein)* *K. Damus (Einstein)*	*1) Two integrated literature reviews:* *- Review of cocaine use during pregnancy looking at prevalence; incidence of LBW, GA, PTD, SGA; and effect on these outcomes of enrollment in PNC or drug treatment program* *- Review of opiate use during pregnancy looking for data on prevalence and LBW outcomes* *2) Chart review of pregnant opiate users who began methadone maintenance pre- versus post- c conception*	*16, 17*
Effectiveness of Recruitment and Retention Strategies in Maternal Substance Abuse Treatment Programs	*M. Freda (Einstein)* *C. Chazotte (Einstein)* *J. Youchah (Einstein)*	*1) Literature review.*	*25*
Cost of Care Estimates of Newborn Exposure to Cocaine, Congenital Syphilis, and Other High-Risk Maternal Behaviors	*C. Phibbs (PAIRE)* *T. Joyce (NY)* *D. Bateman*	*Development of adjusted cost estimates based on New York State newborn DRG reimbursements for live-born infants born at Harlem Hospital in 1989. These cost estimates will provide a benchmark for assessing the cost-effectiveness of strategies to prevent, diagnose, and treat congenital syphilis as well as other diseases related to high-risk maternal behaviors.*	*8*
Alcohol Use During Pregnancy	*C. Ross (Einstein)* *C. Chazotte (Einstein)* *J. Youchah (Einstein)*	*Integrated literature review.*	*Unpublished manuscript*

Elevated Maternal Serum Alpha-Fetoprotein and Subsequent Fetal Loss	*J. Maher* *R. Davis* *R. Goldenberg* *L. Boots*	*Analysis of samples from 6,927 women referred for genetic screening using UAB Genetics database.*	*76*
Use of MMP-9, a Zinc-Dependent Collagenase, as a Predictive Marker for PTD	*R. Goldenberg* *T. Tamura* *M. DuBard*	*Analysis of stored serum samples of women who participated in the Zinc Trial compared with samples from non-pregnant women.*	205
Impact of Maternal Serum Screening Tests on Mid-Trimester Prenatal Diagnosis	*R. Davis* *J. Owen* *K. Wenstrom* *M. DuBard*	*Secondary analysis on 11,222 women referred for mid-trimester (14-22 weeks') genetic counseling from 1989-1994 using the UAB Genetics database.*	108, *181*
PRENATAL CARE			
Selection Bias in Use of Prenatal Care: Accuracy of Measures of the Adequacy of Prenatal Care	*T. Joyce (NY)* *J. Bronstein* *C. Phibbs (PAIRE)*	*Series of multivariate analyses using a large NYC database on pregnant women to develop a model of adequacy of prenatal care. The model attempts to correct for selection bias by using the Kotelchuck Index.*	*Unpublished manuscript*
Effectiveness of Prenatal Care on Rates of Preterm Birth and IUGR	*J. Roseman* *A. Dasanyake* *L. Novakova*	*Literature review of data from articles dated 1985 - 1993 and 1993-June/July 1995.*	*Unpublished*
Relationship Between Ethnicity and Sources of Prenatal Care	*M. Gardner* *R. Goldenberg* *G. Cutter* *S. Cliver*	*Secondary data analysis using the National Maternal and Infant Health Survey (NMIHS) dataset.*	*31, 185*
The Effects of Patient Education on Preterm Birth Prevention	*M. Freda*	*Literature review.*	*Unpublished abstract*
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Work-Related Stress and Pregnancy Outcome: A Contextual Examination	*C. Hickey* *S. Cliver* *F. Mulvihill* *R. Goldenberg* *H. Hoffman (NIH)*	*Secondary analysis using IGP/SGA study data.*	*65, 221*

MULTIPLE MARKER SCREENING TESTS AND OTHER BIOCHEMICAL MARKERS FOR PRETERM BIRTH			
Fetal Fibronectin as a Predictor of PTB in Symptomatic Patients	*A. Peaceman (NWU)* *W. Andrews* *S. Cliver*	*Secondary analysis of data from a multi-center trial conducted by the Fetal Fibronectin Study Group. This analysis consists of data from 725 women who participated in this multi-center trial.*	*241*
Association of Elevated Second Trimester hCG Levels with Poor Pregnancy Outcomes	*K. Wenstrom* *J. Owen* *L. Boots* *M. DuBard*	*Tests for elevated human chorionic-gonadotrophin hormone (hCG) were performed on stored serums of women with poor pregnancy outcomes.*	*265*
Use of Amniotic Fluid Interleukin-6 Level as a Marker for Preexisting Subclinical Intrauterine Inflammation and Prediction of Preterm Birth *1) Use of IL-6 as a Marker* *2) Reliability of a Commercially Available Test for IL-6*	*K. Wenstrom* *W. Andrews* *T. Tamura* *R. Goldenberg* *M. DuBard* *K. Johnson* *G. Hemstreet*	*Analysis of amniotic fluid data for 11,971 women referred to UAB's genetic screening program (1988-1995) using the UAB Genetics Database.*	107, 104, 120, 183, *267*
Association of Maternal Serum Hormone Levels with Fetal Growth Restriction	*M. Gardner* *R. Goldenberg* *S. Cliver* *L. Boots* *H. Hoffman (NIH)*	*Secondary analysis of serum obtained during IGP/SGA study on women at risk for delivering a growth restricted baby.*	36, *188*
The Association Between Plasma Ferritin Concentration, Preterm Delivery, and Low Birthweight	*T. Tamura* *R. Goldenberg* *Y. Neggers* *S. Cliver* *K. Johnson* *R. Copper* *C. Hickey* *M. DuBard*	*Secondary data analysis of lab results from serum collected during SGA/IGP study.*	*48, 98, 101,* 264
Plasma Alkaline Phosphatase as a Predictor of Preterm Birth	*R. Goldenberg* *T. Tamura* *K. Johnson* *M. DuBard* *R. Copper*	*Secondary analysis of Zinc Study data on serial serum samples of 590 black women who delivered preterm at <32 weeks and <37 weeks.*	52, *204*

Predicting Timing of Delivery in Preterm Labor: *1) Relationship of Subsequent PTB to Cervical Dilation After Successful Tocolysis* *2) Examination of Cervical Parameters that Best Predict Preterm Birth* *3) Relationship of GA and Cervical Dilation to the Timing of Delivery*	*D. Guinn* *S. Cliver* *R. Goldenberg* *J. Hauth*	*Series of secondary data analyses using MOD dataset.*	*110, 206, 207, 208*
Use of Ultrasound to Identify Intrauterine Clots and the Association with Preterm Delivery	*R. Davis* *A. Goepfert* *R. Goldenberg* *M. DuBard*	*Retrospective review of pregnancy outcomes for women with identified uterine clots by ultrasound exam.*	*180*
Predication of Spontaneous Preterm Birth: Cervical Exam and Tocodynamometry at 28 Weeks' Gestation	*R. Copper* *R. Goldenberg* *M. DuBard* *J. Hauth* *G. Cutter*	*Secondary analysis of data from LDA trial.*	*20*
Use of Umbilical Artery Doppler Examinations to Predict Preeclampsia or Fetal Growth Retardation	*W. Atkinson* *J. Maher* *J. Owen* *J. Hauth* *R. Goldenberg* *R. Copper*	*Secondary analysis of LDA trial data.*	*5*
Randomized Controlled Trials of Umbilical Artery Doppler Velocimetry: Clinical Utility in High-Risk Pregnancies	*M. Divon*	*Literature synthesis summarizing finding from previous meta-analyses and report of findings from a cumulative meta-analysis.*	*22, 23*
The Predictive Value of Sonographic Fetal Weight Estimates: *1) The Use of Race-Specific Formulas* *2) In Breech Presentation*	*J. Owen* *R. Goldenberg* *M. DuBard* *K Wenstrom*	*1) Use of regression formulas to derive more sensitive measures of fetal growth to improve the predictive value of biometric information.* *2) Use of data from the UAB prenatal ultrasound data set containing data on 40,065 entries from 1 1985-1997 to determine if sonographic accuracy of weight estimates in breech presentation.*	*240, 270*

The Effect of Cigarette Smoking on Neonatal Anthropometric Measures and Intelligence at Ages 1 and 5 for Infants with 150 Gram Decrease in Birthweight	*S. Cliver* *R. Goldenberg* *M. DuBard* *H. Hoffman (CDC)*	*Secondary analysis of SGA/IGP Followup dataset.*	*18*
Relationship of Cigarette Smoking, Placental Calcification, and Fetal Growth Restriction	*S. Cliver* *R. Goldenberg* *L. Klesges (Univ. of TN)* *D. Murray (Univ. of MN)* *J. Brown (Univ. of MN)*	*Secondary analysis of SGA/IGP dataset.*	70
The Relationship of Maternal Skinfold Thickness and Smoking to Birthweight	*Y. Neggers* *R. Goldenberg* *S. Cliver* *H. Hoffman (CDC)* *R. Copper*	*Secondary analysis of SGA/IGP dataset.*	*78*
Smoking During Pregnancy and LBW: The Impact of Smoking Cessation Interventions	*C. Li* *L. Klerman* *G. Cutter* *R. Goldenberg*	*Literature synthesis.*	*Unpublished manuscript*
Health Behavior and Outcomes in Sequential Pregnancies in Black and White Adolescents	*M. Blankson* *R. Goldenberg* *S. Cliver* *C. Hickey*	*Longitudinal, retrospective study of data from OBAR database on rates of birthweight and PTD in a sample of adolescents delivering first and second singleton infants at 20 or more weeks' gestation.*	*10*
Noncompliance in Keeping Prenatal Appointments in a High-Risk Population of Pregnant Women	*M. Blankson* *R. Goldenberg*	*Secondary analysis of the results of telephone follow-up survey of 118 women who missed appointments at a high-risk obstetrics clinic.*	*11*
FAMILY PLANNING AND PREGNANCY INTENDEDNESS			
The Effects of Unwantedness and Abortion on the Incidence of LBW	*R. Ohsfeldt* *S. Gohman (Louisville)* *J. Antel (Houston)*	*Development of an improved structural model that estimates the effects of unwantedness and abortion on the incidence of LBW.*	238, 239 *In Manuscript*

Potential of Family Planning to Impact on LBW Outcomes – *Intendedness: Relationship to LBW Outcomes* – *Interpregnancy Intervals* – *Delaying High-Risk Conceptions: Effectiveness of Family Planning for High Risk Groups*	*L. Klerman* *V. Poole* *S. Phelan* *R. Goldenberg* *S. Cliver* *S. McNeal*	*Systematic literature review focusing on the three basic mechanisms by which family planning might influence the incidence of LBW followed by a series of secondary analysis:* – *Secondary analysis using SGA/IGP dataset looking at intendedness in relationship to maternal behaviors in a population of 1,223 women who answered questions about intendedness early and late in pregnancy* – *Secondary analysis looking at intendedness and LBW outcomes* – *Secondary analysis using OBAR dataset looking at the relationship of interpregnancy intervals to PTB and IUGR. The study sample was 4,408 women who had two consecutive singleton births between 1980 and 1990.* – *Analysis of SGA/IGP data on women who have had more than one pregnancy (consecutive pregnancies) to determine maternal characteristics associated with a short interpregnancy interval*	*42*,72, *73*, 116, 113, *127*, *230*, *232*, *255*, 135 *Unpublished manuscript* *Unpublished abstract*
The Role of Pre- and Inter-Conception Care in Improving the Health of Women and Children	*L. Klerman*	*Conceptual paper incorporating findings from a systematic literature review on the potential for family planning to reduce LBW.*	71, 179

Note:

*Unless otherwise indicated, all investigators are on site at the University of Alabama at Birmingham.

Dataset Descriptions:

OBAR - Obstetrical Automated Records system. This is a historical database of all deliveries at UAB. It contains linked out-patient and hospital data for all Medicaid patients receiving prenatal care through the Jefferson Couty Department of Public Health (Alabama) or the University of Alabama at Birmingham (UAB) high-risk clinic and who deliver at UAB or the UAB run labor and delivery service at the County hospital. The system is used as a clinical research database. The data date back to births since 1979.

SGA/IGP Dataset - The Successive Small-for-Gestational Age/Intrauterine Growth Project prospective data. This dataset contains the information collected during a large prospective study of 1,500 women identified as at risk for delivering a SGA baby from 1986-1988. The SGA dataset is linked to the OBAR system for outcomes data on deliveries in the study population. This dataset is now linked to infant neuro-developmental and maternal followup data for SGA and non-SGA babies born to the original cohort and followed through the first year of life and again at age 5.

UAB ELBW Dataset - Created from a retrospective review of birth logs and OBAR (1979-1991) for VLBW infants (500-1,000 grams) to create a database including prenatal, L&D, newborn, and followup data (UAB ELBW dataset).

UAB Genetics Database - Electronic database including lab results on all women referred to the UAB genetics screening program from 1988. This database can be linked to outcomes data via the OBAR system.

MOD Dataset - The March of Dimes Prematurity Prevention Project. This is a five-center database consisting of data from a randomized clinical trial of the Creasy protocol for prematurity prevention. It contains data on approximately 34,000 deliveries.

IHDP Dataset - The Infant Health and Development Program. An eight-site, randomized controlled trial of comprehensive combined interventions in a sample of low birthweight, premature infants during their first 3 years of life and their families. A total of 985 families and children were enrolled in the study.

Expanded California Dataset - This dataset links infant birth and death certificate data with hospital discharge abstracts in mothers and infants (linked) for in California in 1990 (N=594,104).

VIP Dataset - The Vaginal Infections in Pregnancy (VIP) dataset contains information on 13,172 pregnant women enrolled in a multi-center observational study at 23-26 weeks gestation. Data collection was from 1984-1989 and included medical and social histories as well as cervicovaginal specimens for culture and gram stain.

UAC Dataset - This dataset contains data on 970 live-born infants weighing less than 1,500 grams who were born between October 1, 1989 and April 1, 1991 at 12 perinatal centers across the U.S. Infants who required intraumbilical catheterization were enrolled in a randomized trial. At the time of enrollment, data was abstracted from the maternal chart. This data included use of tocolytic and corticosteroid therapy. Neonatal data were recorded per protocol.

Zinc Study Dataset - This dataset contains data from a randomized trial of zinc supplementation during pregnancy. Data on plasma zinc levels, maternal, and neonatal clinical outcome measures were obtained on a total of 580 low-income African-American women receiving prenatal care in Jefferson County Health Department clinics.

LDA Dataset - Data on 606 healthy nulliparous women with singleton gestations were randomized to a trial of low-dose aspirin therapy. The dataset contains serum samples including measures of serum thromboxane and clinical outcomes measures on the mother and infant.

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APPENDIX C

Cumulative Bibliography

Listing of All LBW PORT Publications (Peer-Reviewed and Other), Manuscripts In Press and Under Review, Peer-Reviewed Abstracts and Presentations, Presentations, and Findings Cited in the Media

APPENDIX C

Cumulative Bibliography

Listing of ASLRW FORT Publications (Peer-Reviewed and Other), Manuscripts In Press and Under Review, Peer-Reviewed Abstracts and Presentations, and Findings Cited in the Studies

Low-Birthweight PORT

Cumulative Bibliography

Updated through March 31, 1998

Published Articles:

1 Andrews WW, Shah SR, Goldenberg RL, Cliver SP, Hauth JC, Cassell GH. Association of post-cesarean delivery endometritis with colonization of the chorioamnion by ureaplasma urealyticum. *Obstet Gynecol* 1995;85(4):509-514.

2 Andrews WW, Goldenberg RL, Hauth JC. Preterm labor: emerging role of genital tract infections. *Infectious Agents and Disease* 1995;4(4):196-211.

3 Andrews WW, Lee HH, Roden WJ, Mott CW. Detection of genitourinary tract chlamydia trachomatis infection in pregnant women by ligase chain reaction assay. *Obstet Gynecol* 1997;89(4):556-560.

4 Atkinson MW, Goldenberg RL. The riddle of prematurity. *The Female Patient* 1994;19:67-77.

5 Atkinson MW, Maher JE, Owen J. The predictive value of umbilical artery Doppler studies for preeclampsia or fetal growth retardation in a preeclampsia prevention trial. *Obstet Gynecol* 1994;83(4):609-612.

6 Atkinson MW, Goldenberg RL, Gaudier FL, Cliver SP, Nelson KG, Merkatz IR, Hauth JC. Maternal corticosteroid and tocolytic treatment and morbidity and mortality in very low birth weight infants. *Am J Obstet Gynecol* 1995;173(1):299-305.

7 Atkinson MW, Guinn D, Owen J, Hauth JC. Does magnesium sulfate affect the length of labor induction in women with pregnancy-associated hypertension? *Am J Obstet Gynecol* 1995;173(4):1219-1222.

8 Bateman DA, Phibbs CS, Joyce T, Heagarty MC. The hospital cost of congenital syphilis. *J Pediatrics* 1997;130(5):752-758.

9 Blair C, Ramey CT, Hardin JM. Early intervention for low birthweight, premature infants: participation and intellectual development. *Am J on Mental Retardation* 1995;99(5):542-554.

10 Blankson ML, Cliver SP, Goldenberg RL, Hickey CA, Jin J, DuBard MB. Health behavior and outcomes in sequential pregnancies of black and white adolescents. *JAMA* 1993;269(11):1401-1403.

11 Blankson ML, Goldenberg RL, Keith B. Noncompliance of high-risk pregnant women in keeping appointments at an obstetric complications clinic. *South Med J* 1994;87(6):634-638.

12 Bronstein JM, Capilouto E, Carlo WA, Haywood JL, Goldenberg RL. Access to neonatal intensive care for low-birthweight infants: the role of maternal characteristics. *Am J Public Health* 1995;85(3):357-361.

13 Bronstein JM, Goldenberg RL. Practice variation in the use of corticosteroids: a comparison of eight datasets. *Am J Obstet Gynecol* 1995;173(1):296-298.

14 Bronstein JM, Cliver SP, Goldenberg RL. Practice variation in the use of intervention in high risk obstetrics. In Press *Health Services Research* 1998;32(6):825-839.

15 Chazotte C. Asthma in pregnancy: a review. *J of the Assn for Academic Minority Physicians* 1994;5(3):107-110.

16 Chazotte C, Youchah JR. Effects of maternal substance abuse. *Current Opinion in Psychiatry* 1994;7:397-399.

17 Chazotte C, Youchah J, Freda MC. Cocaine use during pregnancy and low birthweight: the impact of prenatal care and drug treatment. *Seminars in Perinatology* 1995;19(4):293-300.

18 Cliver SP, Goldenberg RL, Cutter GR, Hoffman HJ, Davis RO, Nelson KG. The effect of cigarette smoking on neonatal anthropometric measurements. *Obstet Gynecol* 1995;85(4):625-630.

19 Copper RL, Goldenberg RL, DuBard MB, Davis RO. Risk factors for fetal death in white, black, and Hispanic women. *Obstet Gynecol* 1994;84(4 Pt 1):490-495.

20 Copper RL, Goldenberg RL, DuBard MB, Hauth JC, Cutter GR. Cervical examination and tocodynamometry at 28 weeks' gestation: prediction of spontaneous preterm birth. *Am J Obstet Gynecol* 1995;172(1 Pt 1):666-671.

21 Copper RL, DuBard MB, Goldenberg RL, Oweis AI. The relationship of maternal attitude toward weight gain to weight gain during pregnancy and low birth weight. *Obstet Gynecol* 1995;85(4):590-595.

22 Divon MY. Randomized controlled trials of umbilical artery Doppler velocimetry: how many are too many? [editorial] *Ultrasound Obstet Gynecol* 1995;6:377-379.

23 Divon MY. Umbilical artery Doppler velocimetry: clinical utility in high-risk pregnancies. *Am J Obstet Gynecol* 1996;174(1 Pt 1):10-14.

24 Fargason CA, Peralta-Carcelen M, Rouse DJ, Cutter GR, Goldenberg RL. The pediatric costs of strategies for minimizing the risk of early onset group B streptococcal disease. In Press *Obstet Gynecol* 1997;90:347-352.

25 Freda MC, Chazotte C, Youchah J. What do we know about how to enroll and retain pregnant drug users in prenatal care? *J Women's Health* 1995;4(1):55-63.

26 Freda MC, DeVore N. Should intravenous hydration be the first line of defense with threatened preterm labor? A critical review of the literature. *J Perinatology* 1996;16(5):385-389.

27 Gardner M, Goldenberg R, Gaudier F, DuBard M, Nelson K, Hauth J. Predicting low Apgar scores of infants weighing less than 1,000 grams: the effect of corticosteroids. *Obstet Gynecol* 1995;85(2):170-174.

28 Gardner M, Goldenberg RL, Cliver SP, Tucker JM, Nelson KG, Copper RL et al. The origin and outcome of preterm twin pregnancies. *Obstet Gynecol* 1995;85(4):553-557.

29 Gardner M, Goldenberg RL. The influence of race and previous pregnancy outcome on outcomes in the current pregnancy. *Seminars in Perinatology* 1995;19(3):191-196.

30 Gardner M, Goldenberg RL. The clinical use of antenatal corticosteroids. *Clin Obstet Gynecol* 1995;38(4):746-754.

31 Gardner M, Goldenberg R, Cliver S, Cutter G. Ethnicity and sources of prenatal care: findings from a national survey. *Birth* 1996;23(2):84-87.

32 Gardner MO, Owen J, Skelly S, Hauth JC. Preterm delivery after indomethacin - a risk factor for neonatal complications? *J Reprod Med* 1996;41(12):903-906.

33 Gardner MO, Rouse DJ, Goldenberg RL, Lanning J, Thom E, Zachary J. Cost comparison of induction of labor versus expectant management in pregnancies lasting longer than 41 weeks. *Am J Managed Care* 1996; 2(7):814-818.

34 Gardner M, Bronstein J, Goldenberg RL, Haywood JL, Cliver SP, Nelson KG. Physician opinions of preterm infant outcome and their effect on antenatal corticosteroid use. *J Perinatology* 1996;16(6):431-434.

35 Gardner MO, Goldenberg RL. Use of antenatal corticosteroids for fetal maturation. *Current Opinion in Obstet Gynecol* 1996; 8(2):106-109.

36 Gardner M, Goldenberg R, Cliver S, Boots L, Hoffman H. Maternal serum concentrations of human placental lactogen, estradiol and pregnancy specific B_1-glycoprotein and fetal growth retardation. *Acta Obstet Gynecol Scand* 1997;S165(76):56-58.

37 Gaudier FL, Goldenberg RL, Nelson KG, Peralta-Carcelen M, Johnson SE, DuBard MB, Roth TY, Hauth JC. Acid-base status at birth and subsequent neurosensory impairment in surviving 500 to 1000 gm infants. *Am J Obstet Gynecol* 1994;170(1 Pt 1):48-53.

38 Gaudier FL, Goldenberg RL, Nelson KG, Peralta-Carcelen M, DuBard MB, Hauth JC. Influence of acid-base status at birth and Apgar scores on survival in 500-1000-g infants. *Obstet Gynecol* 1996;87(2):175-180.

39 Goldenberg RL, Cliver SP, Bronstein J, Cutter GR, Andrews WW, Mennemeyer ST. Bed rest in pregnancy. *Obstet Gynecol* 1994;84(1):131-136.

40 Goldenberg RL. The prevention of low birthweight and its sequelae. *Preventive Med* 1994;23(5):627-631.

41 Goldenberg RL, Hauth JC, DuBard MB, Copper RL, Cutter GR. Fetal growth in women using low-dose aspirin for the prevention of preeclampsia: effect of maternal size. *J Maternal-Fetal Med* 1995;4:218-224.

42 Goldenberg RL, Klerman LV. Adolescent pregnancy - another look [editorial]. *New Eng J Med* 1995;332(17):1161-1162.

43 Goldenberg RL, Tamura T, Neggers Y, Copper RL, Johnson KE, DuBard MB, Hauth JC. The effect of zinc supplementation on pregnancy outcome. *JAMA* 1995;274(6):463-468.

44 Goldenberg RL, Tamura T. Prepregnancy weight and pregnancy outcome [editorial]. *JAMA* 1996;275(14):1127-1128.

45 Goldenberg RL, Klebanoff MA, Nugent R, Krohn MA, Hillier S, Andrews WW. Bacterial colonization of the vagina during pregnancy in four ethnic groups. *Am J Obstet Gynecol* 1996;174(5):1618-1621.

46 Goldenberg RL, Andrews WW. Intrauterine infection and why preterm prevention programs have failed [editorial]. *Am J Public Health* 1996;86(6):781-783.

47 Goldenberg RL, Cliver SP, Mulvihill FX, Hickey CA, Hoffman HJ, Klerman LV, Johnson MJ. Medical, psychosocial and behavioral risk factors do not explain the increased risk for low-birth weight among black women. *Am J Obstet Gynecol* 1996;175(5):1317-1324.

48 Goldenberg RL, Tamura T, DuBard M, Johnston KE, Copper RL, Neggers Y. Plasma ferritin and pregnancy outcome. *Am J Obstet Gynecol* 1996;175(5):1356-1359.

49 Goldenberg RL, DuBard MB, Cliver SP, Nelson KG, Blankson K, Ramey SL, Herman A. Pregnancy outcome and intelligence at age five years. *Am J Obstet Gynecol* 1996;175(6):1511-1515.

50 Goldenberg RL, Rouse DJ. Preterm birth, cerebral palsy and magnesium. *Nature Medicine* 1997;3(2):146-147

51 Goldenberg RL, Andrews WW, Yuan A, McKay T, St. Louis M. Sexually transmitted diseases and adverse outcomes of pregnancy. *Clinics in Perinatology* 1997;24(1):23-41.

52 Goldenberg RL, Tamura T, DuBard M, Johnston KE, Copper RL, Neggers Y. Plasma alkaline phosphatase and pregnancy outcome. *J Maternal Fetal Med* 1997;6:140-145.

53 Goldenberg RL, Cliver SP, Cutter GR, Hoffman HJ, Copper RL, DuBard MD. The relationship between maternal characteristics and fetal and neonatal anthropometric measurements in women delivering at term: a summary. *Acta Obstet Gynecol Scand* 1997;S165(76):8-13.

54 Goldenberg RL, Hickey CA, Cliver SP, Gotlieb S, Woolley TW, Hoffman JH. Abbreviated scale for the assessment of psychosocial status in pregnancy: development and evaluation. *Acta Obstet Gynecol Scand* 1997;S165(76):19-29.

55 Goldenberg RL, Cliver SP. Small for gestational age and intrauterine growth restriction: Definitions and standards. *Clinical Obstetrics and Gynecology* 1997;40(4):704-714.

56 Goldenberg RL, Andrews WW, Hauth JC. Markers of preterm birth. *Prenat Neonat Med* 1998;3:43-46.

57 Goldenberg RL, Hoffman HJ, Cliver SP. Neurodevelopmental outcome of small-for-gestational-age infants. *Eur J Clin Nutr* 1998;52:S1:S54-S58.

58 Hauth JC, Goldenberg RL, Parker CR, Cutter GR, Cliver SP. Low-dose aspirin: lack of association with an increase in abruptio placentae or perinatal mortality. *Obstet Gynecol* 1995;85(6):1055-1058.

59 Hauth JC, Goldenberg RL, Parker CR, Copper RL, Cutter GR. Maternal serum thromboxane B_2 reduction versus pregnancy outcome in a low-dose aspirin trial. *Am J Obstet Gynecol* 1995;173(2):578-584.

60 Hauth JC, Goldenberg RL, Andrews WW, DuBard MB, Copper RL. Reduced incidence of preterm delivery with metronidazole and erythromycin in women with bacterial vaginosis. *New Eng J Med* 1995;333(26):1732-1736.

61 Hauth JC, Andrews WW, Goldenberg RL. Infection-related risk factors predictive of spontaneous preterm labor and birth. *Prenat Neonat Med* 1998;3:86-90.

62 Haywood JL, Goldenberg RL, Bronstein J, Nelson KG, Carlo WA. Comparison of perceived and actual rates of survival and freedom from handicap in premature infants. *Am J Obstet Gynecol* 1994;171(2):432-439.

63 Hickey CA, Cliver SP, Goldenberg RL, Kohatsu J, Hoffman HJ. Prenatal weight gain, term birth weight, and fetal growth retardation among high-risk multiparous black and white women. *Obstet Gynecol* 1993;81(4):529-535.

Also, condensed in *Family Planning Perspectives* 1993;25:281-282.

64 Hickey CA, Cliver SP, McNeal SF, Hoffman HJ, Goldenberg RL. Prenatal weight gain patterns and spontaneous preterm birth among nonobese black and white women. *Obstet Gynecol* 1995;85(6):909-914.

65 Hickey CA, Cliver SP, Mulvihill FX, McNeal SF, Hoffman HJ, Goldenberg RL. Employment related stress and preterm delivery: a contextual examination. *Public Health Reports* 1995;110(4):410-418.

66 Hickey CA, Cliver SP, McNeal SF, Hoffman HJ, Goldenberg RL. Relationship of psychosocial status to low prenatal weight gain among nonobese black and white women delivering at term. *Obstet Gynecol* 1995;86(2):177-183.

67 Hickey CA, Cliver SP, McNeal SF, Hoffman HJ, Goldenberg RL. Prenatal weight gain patterns and birth weight among nonobese black and white women. *Obstet Gynecol* 1996;88(4):490-496.

68 Hickey CA, Cliver SP, McNeal SF, Goldenberg RL. Low pregravid body mass index as a risk factor for preterm birth: variation by ethnic group. *Obstet Gynecol* 1997;89(2):206-212.

69 Hickey CA, Cliver SP, Goldenberg RL, McNeal SF, Hoffman HJ. Low prenatal weight gain among low-income women: what are the risk factors? *Birth* 1997;24(2):102-108.

70 Klesges LM, Murray DM, Brown JE, Cliver SP, Goldenberg RL. Relationships of cigarette smoking and dietary antioxidants with placental calcification. *American J Epidemiology* 1998;147(2):127-135.

71 Klerman LV, Reynolds DW. Interconception care: a new role for the pediatrician. *Pediatrics* 1994;93(2):327-329.

72 Klerman LV, Klerman JA. More evidence for the public health value of family planning. *Am J Public Health* 1994;84(9):1377-1378.

73 Klerman LV, Phelan ST, Poole VL, Goldenberg RL. Family planning: an essential component of prenatal care. *J Am Medical Women's Assn* 1995;50(5):147-151.

74 Leviton L, Baker S, Hassol A, Goldenberg RL. An exploration of opinion and practice patterns affecting the use of antenatal corticosteroids. *Am J Obstet Gynecol* 1995;173(1):312-316.

75 Maher JE, Goldenberg RL. Outcomes of very-low-birth-weight infants after maternal corticosteroid therapy before 28 weeks' gestation [letter]. *Am J Obstet Gynecol* 1993;169(5):1363-1364.

76 Maher JE, Davis RO, Goldenberg RL, Boots LR, DuBard MB. Unexplained elevation in maternal serum alpha-fetoprotein and subsequent fetal loss. *Obstet Gynecol* 1994;83(1):138-141.

77 Maher JE III, Cliver SP, Goldenberg RL, Davis RO, Copper RL. The effect of corticosteroid therapy in the very premature infant. *Am J Obstet Gynecol* 1994;170(3):869-873.

78 Neggers Y, Goldenberg R, Cliver S, Hoffman H, Copper R. The relationship between maternal skinfold thickness, smoking and birthweight in black and white women. *Pediatric and Perinatal Epidemiology* 1994;8(2):216-221.

79 Neggers Y, Goldenberg RL, Cliver SP, Hoffman HJ, Cutter GR. The relationship between maternal and neonatal anthropometric measurements in term newborns. *Obstet Gynecol* 1995;85(2):192-196.

80 Neggers YH, DuBard MB, Goldenberg RL, Tamura T, Johnston KE, Copper RL, Hauth JC. Factors influencing plasma zinc levels in low-income pregnant women. *Biological Trace Element Research* 1996;55(1-2):127-135.

81 Neggers YH, Goldenberg RL, Tamura T, Cliver SP, Hoffman HJ. The relationship between maternal dietary intake and infant birthweight. *Acta Obstet Gynecol Scand* 1997;S165(76):71-75.

82 Neggers YH, Goldenberg RL, Tamura T, Johnson KE, Copper RL, DuBard MB. Plasma and erythrocyte zinc intake and zinc supplementation during pregnancy in low-income African-American women. *J Am Diet Assoc* 1997;97(11):1269-1274.

83 Nelson KG, Goldenberg RL, Hoffman HJ, Cliver SP. Growth and development during the first year in a cohort of low income term-born American children. *Acta Obstet Gynecol Scand* 1997;S165(76):87-92.

84 Olausson PMO, Cnattingius S, Goldenberg RL. Determinants of poor pregnancy outcomes among teenagers in Sweden. *Obstet Gynecol* 1997;89(3):451-457.

85 Peralta-Carcelen M, Fargason CA, Cliver SP, Cutter GR, Gigante J, Goldenberg RL. Impact of maternal group B streptococcal screening on pediatric management in full-term newborns. *Arch Pediatr Adolesc Med* 1996;150:802-808.

86 Peralta-Carcelen M, Fargason C, Coston D, Dolan J. Preferences of pregnant women and physicians for two strategies for prevention of early-onset group B streptococcal sepsis in neonates. *Arch Pediatr Adolesc Med* 1997;151:712-718.

87 Phibbs CS, Bronstein JM, Buxton E, Phibbs RH. The effects of patient volume and level of care at the hospital of birth on neonatal mortality. *JAMA* 1996;276(13):1054-1059.

88 Piper JM, Atkinson MW, Mitchel EF, Cliver SP, Snowden M, Wilson SC. Improved outcomes for very low birth weight infants associated with the use of combined maternal corticosteroids and tocolytics. *J Reproductive Med* 1996;41(9):692-698.

89 Rouse D, Goldenberg R, Cliver S, Cutter G, Mennemeyer S, Fargason C. Strategies for the prevention of early-onset neonatal group B streptococcal sepsis: a decision analysis. *Obstet Gynecol* 1994;83(4):483-494.

90 Rouse DJ, Andrews WW, Goldenberg RL, Owen J. Screening and treatment of asymptomatic bacteriuria of pregnancy to prevent pyelonephritis: a cost-effectiveness and cost-benefit analysis. *Obstet Gynecol* 1995;86(1):119-123.

91 Rouse DJ, Owen J, Goldenberg RL, Vermund SH. Zidovudine for the prevention of vertical HIV transmission: a decision analytic approach. *J Acquired Immune Deficiency Syndromes* 1995;9(4):401-407.

92 Rouse DJ, Owen J, Goldenberg RL, Cliver SP. Determinants of the optimal time in gestation to initiate antenatal fetal testing: a decision-analytic approach. *Am J Obstet Gynecol* 1995;173(5):1357-1363.

93 Rouse DJ, Gardner M, Allen SJ, Goldenberg RL. Management of the presumed susceptible varicella (chickenpox)-exposed gravida: a cost-effectiveness/cost-benefit analysis. *Obstet Gynecol* 1996;87(6):932-936.

94 Rouse DJ, Hauth JC, Nelson KG, Goldenberg RL. The feasibility of a randomized clinical perinatal trial: maternal magnesium sulfate for the prevention of cerebral palsy. *Am J Obstet Gynecol* 1996;175(3):701-705.

95 Rouse DJ, Owen J, Goldenberg RL, Cliver SP. The effectiveness and costs of elective cesarean delivery for fetal macrosomia diagnosed by ultrasound. *JAMA* 1996;276(18):1480-1486.

96 Rouse DJ, Hauth JC, Andrews WW, Mills BB, Maher JE. Chlorhexidine vaginal irrigation for the prevention of peripartal infection: a placebo-controlled randomized clinical trial. *Am J Obstet Gynecol* 1997;176:617-622.

97 Rouse DJ, Goldenberg RL, Wenstrom KD. Antenatal screening for factor V Leiden mutation: a critical appraisal. *Obstet Gynecol* 1997;90(5):848-851.

98 Tamura T, Goldenberg RL, Johnston KE, DuBard MB. Effect of smoking on plasma ferritin concentrations in pregnant women. *Clin Chem* 1995;41(8 Pt 1):1190-1191.

99 Tamura T, Goldenberg RL, Johnston K, Freeberg LE. In vitro zinc stimulation of angiotensin-converting enzyme activities in human plasma. *J Nutritional Biochemistry* 1996;(7):55-59.

100 Tamura T, Goldenberg RL. Zinc nutriture and pregnancy outcome. *Nutrition Research* 1996;16(1):139-181.

101 Tamura T, Goldenberg RL, Johnston KE, Cliver SP, Hickey CA. Serum ferritin: a predictor of early spontaneous preterm delivery. *Obstet Gynecol* 1996;87(3):360-365.

102 Tamura T, Johanning GL, Goldenberg RL, Johnston KE, DuBard MA. Effect of angiotensin-converting enzyme gene polymorphism on pregnancy outcome, enzyme activity, and zinc concentration. *Obstet Gynecol* 1996;88(4):497-502.

103 Tamura T, Goldenberg RL, Cliver SP, Hoffman HJ. Serum concentrations of zinc, folate, vitamins A and E, and proteins, and their relationships to pregnancy outcome. *Acta Obstet Gynecol Scand* 1997;S165(76):63-70.

104 Tamura T, Andrews WW, Johnston KE, Hemstreet GP, Goldenberg RL. Measurement of amniotic fluid interleukin-6 using commercial kits. *J Infectious Diseases Obstet Gynecol* 1997;5:222-225.

105 Tamura T, Goldenberg RL, Johnson KE, Cliver SP. Serum leptin concentrations during pregnancy and their relationship to fetal growth. *Obstet Gynecol* 1998;91(3):389-395.

106 Wenstrom KD, Hauth JC, Goldenberg RL, DuBard MB, Lea C. The effect of low-dose aspirin on pregnancies complicated by elevated human chorionic gonadotropin levels. *Am J Obstet Gynecol* 1995;173(4 Pt 1):1292-1296.

107 Wenstrom KD, Andrews WW, Tamura T, DuBard MB, Johnston KE, Hemstreet GP. Elevated amniotic fluid interleukin-6 levels at genetic amniocentesis predict subsequent pregnancy loss. *Am J Obstet Gynecol* 1996;175(4):830-833.

108 Wenstrom KD, Owen J, Brumfield CG, Davis RO, DuBard MA, Garcia T. Significance of a false-positive trisomy 18 multiple-marker screening test. *Obstet Gynecol* 1997;90(6):938-942.

Papers In Press:

109 Goldenberg RL, Rouse DJ. The prevention of prematurity. *N Engl J Med* (In Press).

110 Guinn DA, Goldenberg RL, Cliver SP. Relationship of gestational age and cervical dilation to the timing of delivery. *Am J Obstet Gynecol* (In Press).

111 Kimberlin DF, Andrews WW. Bacterial vaginosis: association with adverse pregnancy outcomes. *Sem Perinatol* (In Press).

112 Haywood JL, Morse SB, Goldenberg RL, Bronstein J, Nelson KG, Carlo WA. Pediatricians who underestimate neonatal outcome restrict the use of neonatal interventions. *Pediatr* 1998 (In Press)

113 Klerman LV, Cliver SP, Goldenberg RL. The impact of short interpregnancy intervals on pregnancy outcomes in a low income population. *Am J Public Health* June 1998 (In Press).

114 Owen J. Prophylactic cesarean for prenatally diagnosed malformations. *Clinical Obstet Gynecol Symposium on Evidenced-based Obstetrics and Gynecology* Rouse DJ, ed (In Press).

115 Phelan ST, Goldenberg RL, Alexander G, Cliver SP. Perinatal mortality and its relationship to reporting of low birthweight infants. In Press *AJPH.*

116 Poole VL, Klerman LV, Flowers JS, Goldenberg RL, Cliver SP. Pregnancy intendedness and maternal behaviors in a low-income high risk population. *J Nursing Science* (In Press).

117 Rouse DJ, Owen J. Decision Analysis. *Clinical Obstet Gynecol*. Pitkin RM, Scott JR, eds (In Press).

118 Rouse DJ, Owen J, Goldenberg RL. Routine maternal platelet count: an assessment of a technologically-drive screening practice. *Am J Obstet Gynecol* (In Press).

119 Wenstrom KD, Andrews WW, Hauth JC, Goldenberg RL, DuBard MB, Cliver SP. Elevated second trimester amniotic fluid interleukin-6 levels predict preterm delivery. In Press *Am J Obstet Gynecol.*

Papers Under Review:

120 Andrews WW, Goldenberg RL, Tamura T, Wenstrom KD, DuBard M, Johnston KE. Correlation of Ferritin Levels with elevated interleukin-6 in mid-trimester amniotic fluid. (Under Review)

121 Atkinson MW, Cliver SP, McNeal S, Cutter G, Malloy MH, Goldenberg RL. The association between maternal corticosteroid and tocolytic therapy and neonatal outcome in very low birthweight infants (Under Review).

122 Barefield ES, Nelson KG, Cliver SP, Bishnoi R, Goldenberg R. Cost of neonatal care by gestational age and survival (Under Review).

123 Cifuentes J, Bronstein J, Phibbs C, Phibbs R, Carlo WA. Risk for mortality according to level of neonatal care at birth in low birthweight infants (Under Review).

124 Fargason CA, Peralta-Carcelen M, Cutter GR, Rouse DJ, Cliver SP, Goldenberg RL. Change in costs of pediatric care associated with adoption of the consensus group B streptococcal pediatric care guidelines (Under Review).

125 Leviton LC, Goldenberg RL, Baker CS, Schwartz RM, Fred MC, Fish LJ, Cliver SP, Rouse DJ, Chazotte C, Merkatz IR, Raczynski JM. Dissemination can affect practice: randomized controlled trial of methods to encourage the use of antenatal corticosteroid therapy for fetal maturation (Under Review).

126 Phibbs CS, Bronstein JM, Buxton E, Phibbs RH. The effect of linking discharge data to birth certificate data on risk-adjusted neonatal mortality (Under Review).

127 Poole VL, Flower JS, Goldenberg RL, Cliver SP. Pregnancy intendedness at early and late pregnancy in a low-income, high risk population (Under Review).

128 Rouse DJ, Andrew WW, Lin C, Mott CW, Ware JC, Philips JB. Antibiotic susceptibility profile of vertically acquired group B streptococcus. (Under Review).

Books, Chapters, and Non-Peer Reviewed Publications:

129 Blair C, Ramey CT. *Early Intervention for Low Birth Weight Infants: The Path to Second Generation Research.* In: M. Guralnick (Ed.) The Effectiveness of Early Intervention: Second Generation Research. Baltimore: Paul H. Brookes Co., 1996:77-97.

130 Goldenberg RL. *Small for Gestational Age infants.* In: Reproductive Health Care for Women and Babies. Section V. Impact of Adverse Infant Outcomes. Edited by BP Sachs, R Beard, E Papiernick, C Russell. Oxford University Press, New York, 1995;391-399.

131 Goldenberg RL, Andrews WW. *Pregnancy Outcomes Related to Infectious Diseases.* In: Trent McKay (Eds.), STDs and Adverse Outcomes in Pregnancy Meeting. Centers for Disease Control, May 1994. In Press.

132 Goldenberg RL, Bronstein JM. *Preventing Low Birthweight.* In: Wallace HH, Sweeny PJ (Eds.), Maternal and Child Health Practices. 4th Edition. Oakland, CA: Third Party Publishing Company, 1994.

133 Goldenberg RL. Routine iron supplementation during pregnancy: Commentary 1. *Abstracts of Clinical Care Guidelines* 1994;6(2):15-18.

134 Goldenberg RL, Nelson KG. *Cerebral Palsy.* In: Creasy R, Resnick R (Eds.), Maternal-Fetal Medicine: Principals and Practice. 4th Edition. Saunders Publishing (In Press).

135 Klerman LV, Merkatz IR. *Maternity-Related Health Care in the United States.* In: Sachs BP, Beard R, Papiernik E, Russell C (Eds.) Reproductive Health Care for Women and Babies. Policy and Ethics. New York, NY: Oxford University Press, 1995; 207-235.

136 Klerman LV. *Promoting the Health of Women and Children.* In: DiClemente R, Raczynski R (Eds.), Handbook of Health Promotion and Disease Prevention. (In Press).

137 Ramey CT, Shearer D. *Conceptual Framework for Interventions for Low Birthweight and Premature Children.* In: E. Goldson (Ed.), Nurturing the Premature Infant: Developmental Interventions in the Neonatal Intensive Care Nursery. Oxford University Press. In Press

138 Ramey CT, Ramey SL. *Early Intervention: Optimizing Development for Children with Disabilities and Risk Conditions.* In: M. Wolraich (Ed.), Disorders of Development and Learning: A Practical Guide to Assessment and Management. 2nd Edition. Philadelphia: Mosby-Year Book, Inc., 1996:141-158.

139 Rouse DJ (Ed.). *Symposium on Evidence-based Practice.* In: Clinical Obstetrics and Gynecology, June 1998 (In Press).

In Manuscript:

140 Andrews WW, Hauth JC, Goldenberg RL, DuBard M, Chandra G, Copper RL. Single and multiple markers of altered vaginal flora: effect of treatment on preterm birth (PTB) (In Manuscript)

141 Bronstein JM, Phibbs CS, Phibbs RH. Impact of payer source on neonatal mortality: California 1990. (In Manuscript)

142 Chazotte C, Youchah J, Ross C. Prenatal alcohol exposure: prevalence, effects, and interventions. A review. (In Manuscript)

143 Fish LJ, Leviton LC, Goldenberg RL, Schwartz RM, Raczynski JM, Rouse DJ, Baker CS, Cliver SP, Freda MC. Statistical modeling of changes in practice after guideline dissemination. (In Manuscript).

144 Gigante J, et al. Impact of universal screening for group B streptococcus on management of mildly symptomatic term infants (In Manuscript).

145 Klerman L. Family Planning: Need and opportunities (In Manuscript).

Presented at "The effectiveness of Prenatal Care: New Evidence, New Paradigms." Harvard, June 27, 1997. Boston, MA.

146 Leviton LC, Goldenberg RL, Raczynski JM, Schwartz RM, Baker CS, Cliver SP, Rouse DJ, Freda MC, Fish LJ. Rationale and methods for a dissemination study on antenatal corticosteroid therapy (In Manuscript).

147 Leviton LC, Baker CS, Freda MC, Fish LJ, Goldenberg RL, Rouse DJ, Schwartz RM. Exploratory qualitative and quantitative analysis of a dissemination study on antenatal corticosteroid therapy. (In Manuscript).

148 Morse S, Bronstein JM, Haywood J, Carlo W. Obstetricians' estimates of survival and freedom from handicap in extremely preterm infants: results of a national survey (In Manuscript).

149 Peralta-Carcelen M, Jackson DS, Nelson KG, Royal SA. Growth and sexual maturation of extremely low birth weight (ELBW) adolescents (In Manuscript)

150 Peralta-Carcelen M, Hart MB, Nelson KG, Hodgen B. Growth and cognitive outcomes of extremely low birth weight (ELBW) adolescents (In Manuscript)

151 Peralta-Carcelen M, Goran MI, Nelson KG, Yuan A. Body composition in extremely low birth weight (ELBW) adolescents (In Manuscript).

152 Phibbs CS, Bronstein JM. The relation between obstetric risk factors and neonatal outcomes: use of linked birth, death and maternal discharge abstract data (California 1990) to post identify infants at risk for poor neonatal outcome by level of care at delivery (In Manuscript)

153 Phibbs CS, Bronstein JM. Analysis of prenatal care for high-risk women (California 1990 Linked Dataset): are there differences by type of insurance or by minority status? (In Manuscript)

154 Phibbs CS, Baker LC, Wheeler SK, Phibbs RH. Can we explain the differences in neonatal mortality between patients insured by health maintenance organizations and patients insured by other private insurance in California? (In Manuscript)

155 Poole VL, Cliver SP. Pregnancy intendedness and neonatal outcome in a low-income, high risk population (In Manuscript).

156 Ohsfeldt RL, Gohmann SF, Antel JJ. Unintended pregnancies, sample selection, and birth outcomes. (In Manuscript)

157 Ramey SL, Klerman LV, Goldenberg RL, Hou J, Cliver SP, Steele R. A theory-driven approach to prenatal care: results of a randomized trial of prenatal interventions targeted at low-income African-American women identified by selected risk factors (In Manuscript).

158 Schwartz RM, Bronstein J, Kellogg RJ, Zhao Q. Antenatal hospitalizations in 29 perinatal centers: utilization and resource use (In Manuscript).

Peer-Reviewed Abstracts and Presentations:

159 Andrews W, Shah S, Goldenberg R, Cassell G, Hauth J, Roden W. Post-cesarean endometritis: role of asymptomatic antenatal colonization of the chorioamnion with ureaplasma urealyticum. *Am J Obstet Gynecol* 1994;170(Pt 2):A512.

160 Andrews WW, Hauth JC, Goldenberg RL, DuBard M, Chandra G, Copper RL. Single and multiple markers of altered vaginal flora: effect of treatment on preterm birth (PTB). *Am J Obstet Gynecol* 1996;174(1 Pt 2):A46.

Oral presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

161 Andrews WW, Lee H, Roden WJ, Mott CW. Detection of genitourinary tract chlamydia infection in pregnant women by ligase chain reaction assay. *Am J Obstet Gynecol* 1996;174(1 Pt 2):A361.

Oral presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

162 Atkinson MW, Gaudier FL, Cliver SP, Nelson K, Peralta M, Hauth JC, Goldenberg RL. The interaction of maternal corticosteroid and tocolytic treatment on morbidity and mortality rates in very low birthweight infants. *Am J Obstet Gynecol* 1994;170(1 Pt 2):A400.

163 Atkinson M, Cliver S, McNeal S, Cutter G, Goldenberg R. Maternal corticosteroid and tocolytic therapy in very low birth weight infants. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A572.

Presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

164 Barefield ES, Nelson KG, Fargason CA. Cost of neonatal care for premature infants since introduction of surfactant. *Clinical Research* 1993;41(4):A735.

Presentation at the Southern Society for Pediatric Research meeting.

165 Barefield ES, Nelson KG, Fargason CA. Cost of neonatal care for premature infants by survival in the post-surfactant era. *Pediatric Research* 1994;35(4):A1568.

Presentation at the Society for Pediatric Research Annual Meeting.

166 Barefield ES, Bishnoi RR, Nelson KG, Goldenberg RL. Population costs for newborn infants by survival and gestation age. *J Investigative Med* 1996;44(1):A14.

Presentation at the Southern Society of Pediatric Research Annual Meeting.

167 Barefield ES, Bishnoi RR, Cliver SP, Nelson KG, Goldenberg RL. Population costs for newborns by survival and gestational age (GA). *Pediatric Research* 1996;39(4 Pt 2):A1526.

Presentation at the Society for Pediatric Research Annual Meeting and a media interview.

168 Blair CB, Ramey CT. Attenuating the IQ decline associated with at-risk status.

Poster presentation at the Gatlinburg Conference on Mental Retardation. Gatlinburg, TN; March 1993.

169 Blair CB, Ramey CT. Multivariate analysis of children and families' participation in the Infant Health and Development Program.

Paper presented at the Society for Research in Child Development meeting. New Orleans, LA; March 1993.

170 Blair CB, Ramey CT. Longitudinal analysis of an early intervention program.

Poster presentation at the American Association on Mental Retardation meeting. Washington, DC; June 1993.

171 Blair CB, Ramey CT. A risk index for low birth weight infants.

Abstract presented at the Gatlinburg Conference on Research Theory in Mental Retardation and Developmental Disability. Gatlinburg, TN; March 1994.

172 Bronstein JM, Cliver S, Goldenberg RL. Racial differences in the use of corticosteroids in preterm labor.

Poster presentation at the Association for Health Services Research meeting. Chicago, IL; June 4, 1995.

173 Bronstein JM, Phibbs CS, Phibbs RH. Impact of payment source on neonatal mortality: California 1990.

Presentation at the American Public Health Association 124th Annual Meeting. November 1996.

174 Cifuentes J, Bronstein J, Phibbs C, Phibbs R, Carlo WA. Risk for mortality according to level of neonatal care at birth in low birth weight (LBW) infants. *Pediatric Research* 1996;39(4 Pt 2):A1546.

Poster presentation at the Society for Pediatric Research Annual Meeting.

175 Cifuentes J, Mariani G, Zola EM, Mitchell B, Carlo WA. Does surfactant administration reduce the incidence of bronchopulmonary dysplasia (BPD)? *Pediatric Research* 1996;39(4 Pt 2):A1192.

Poster presentation at the Society for Pediatric Research Annual Meeting.

176 Cliver S, Goldenberg R, Hickey C, Hoffman H, Copper R. The relationship of psychosocial status to preterm delivery in multiparous women.

Oral presentation at the American Public Health Association 121st Annual Meeting. San Francisco, CA; October 1993.

177 Cliver S, Goldenberg R, Rouse D, Hauth J, Roden W. Risk factors for preeclampsia in nulliparous and multiparous women. *Am J Obstet Gynecol* 1994;170(Pt 2):A55.

Oral presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

178 Cliver S, Tamura T, Goldenberg RL, Johnson K. Serum leptin concentrations during pregnancy and their relationship to fetal growth. *Am J Obstet Gynecol* 1998;178(1 Pt 2):S38.

Poster presentation at the Society of Perinatal Obstetricians 1998 Annual Meeting.

179 Collis-Mele N, Klerman LV. An interconception care program for a low income population.

Presentation at the American Public Health Association 123rd Annual Meeting. San Diego, CA; October 1995.

180 Davis R, Goepfert A, Goldenberg R, DuBard M. Identification of intrauterine clot on ultrasound examination is associated with preterm delivery. *Am J Obstet Gynecol* 1994;170(Pt 2):A397.

Poster presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

181 Davis RO, Cosper P, DuBard M, Brumfield CG, Finley S, Owen J, Wenstrom K. The impact of maternal serum screening tests on mid-trimester prenatal diagnosis. *Am J Obstet Gynecol* 1996;174(1 Pt 2):A471.

Oral presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

182 Davis RO, Cosper P, DuBard M, Brumfield CG, Wenstrom K, Owen J. Spontaneous pregnancy losses in women referred for mid-trimester genetic counseling. *Am J Obstet Gynecol* 1996;174(1 Pt 2):A473.

Oral presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

132 Davis RO, Brumfield CG, DuBard M, Owen J, Wenstrom KD. An assessment of fetal loss in twin pregnancy after midtrimester amniocentesis. *Am J Obstet Gynecol* 1997;176(1 Pt 2):A23.

Oral presentation at the Society of Perinatal Obstetricians 1997 Annual Meeting.

183 Davis RO, Andrews WW, DuBard M, Wenstrom KD, Hauth JC. Mid-trimester interleukin-6 levels in twin pregnancies. *Am J Obstet Gynecol* 1997;176(1 Pt 2):A164.

Poster presentation at the Society of Perinatal Obstetricians 1997 Annual Meeting.

184 Fargason C, Peralta M, Cliver S, Cutter G. Impact of prenatal screening for group B streptococcal colonization on postnatal pediatrics costs.

Poster presentation at the Society for Medical Decision Making meeting. October 1994.

185 Gardner M, Goldenberg R, Cliver S, Cutter G. Ethnicity and prenatal care. *Am J Obstet Gynecol* 1994;170(Pt 2):A236.

Presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

186 Gardner M, Goldenberg RL, Cliver SP, Tucker JM, Nelson KG, Copper RL et al. The origin and outcome of preterm twin pregnancies. *Am J Obstet Gynecol* 1994;170(Pt 2):A401.

Poster presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

187 Gardner M, Goldenberg RL, Gaudier F, DuBard M, Nelson K, Hauth J. Predicting low Apgar scores in the very preterm infant.

Poster presentation at the American College of Obstetricians and Gynecologists. Orlando, FL; May 1994.

188 Gardner M, Goldenberg R, Cliver S, Boots L, Hoffman H. Maternal serum concentrations of human placental lactogen, estradiol and pregnancy specific B glycoprotein and fetal growth retardation. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A110.

Presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

189 Gardner M, Skelly S, Owen J. Neonatal complications associated with prenatal use of indomethacin. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A564.

Presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

190 Gardner M, Rouse DJ, Goldenberg RL, Lanning J. Cost comparison of induction at 41 weeks versus expectant management in the post-term pregnancy. *Am J Obstet Gynecol* 1996;174(1 Pt 2).

Presentation at the Society of Perinatal Obstetricians 16th Annual Meeting.

191 Gardner M, Cliver S, Hou J, Du Bard M, Goldenberg R. Factors associated with a higher IQ score in 5 year old African-American children. *Am J Obstet Gynecol* 1998;178(1 Pt 2):S130.

Poster presentation at the Society of Perinatal Obstetricians 1998 Annual Meeting.

192 Gaudier F, Goldenberg R, DuBard M, Nelson K, Hauth J. Acid-base status at birth in small for gestational age vs appropriate for gestational age <1,000-gram infants. *Am J Obstet Gynecol* 1994;170(Pt 2):A112.

Poster presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

193 Gaudier F, Goldenberg R, Hauth J, DuBard M, Nelson K. Are neonatal outcomes better in very preterm births complicated by preeclampsia and PROM? *Am J Obstet Gynecol* 1994;170(Pt 2):A402.

Presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

194 Gaudier F, Peralta M, Goldenberg R, Nelson K, DuBard M, Johnson S et al. Survival and long term neurologic outcome of infants 23 to 27 weeks, 1979-1985 vs 1986-1991. *Am J Obstet Gynecol* 1994;170(Pt 2):A403.

Presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

195 Gaudier F, Goldenberg R, DuBard M, Nelson K, Hauth J. Influence of acid-base status and Apgar scores on survival in 500 to 1000 g infants. *Am J Obstet Gynecol* 1994;170(Pt 2):A404.

Presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

196 Gigante J, Hickson GB, Fargason Jr CA, Peralta-Carcelen M, Miller CS. Universal screening and maternal chemoprophylaxis for group B streptococcus and its effect on management of mildly symptomatic term infants. *Arch Pediatr Adolecs Med* 1996;150:P77.

Presentation at the Southern Society for Pediatric Research meeting. New Orleans, LA; February 1, 1996.

197 Gigante J, Hickson GB, Fargason Jr CA, Peralta-Carcelen M, Miller CS. Impact of universal screening for group B streptococcus on management of mildly symptomatic term infants.

Presentation at the Ambulatory Pediatric Association meeting, Washington, DC; May 6-9, 1996.

198 Goepfert AR, Klebanoff M, Goldenberg RL, Nugent R and the VIP Study Group, University of Alabama at Birmingham, AL and the NICHD, Bethesda, MD. Is bacterial vaginosis (BV) in pregnant women a sexually transmitted disease (STD): variation by ethnicity. *Am J Obstet Gynecol* 1997;176(1 Pt 2):A98.

Poster presentation at the Society of Perinatal Obstetricians 1997 Annual Meeting.

199 Goldenberg R, Cliver S, Rouse D, Hauth J, Roden W, Copper R. Neonatal consequences of maternal preeclampsia: the effect of maternal risk status. *Am J Obstet Gynecol* 1994;170(Pt 2):A345.

Presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

200 Goldenberg R, Gaudier F, Nelson K, Peralta M, DuBard M, Cliver S et al. The relationship of maternal and neonatal characteristics to major handicap at > one year of age. *Am J Obstet Gynecol* 1994;170(Pt 2):A346.

Poster presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

201 Goldenberg R, DuBard M, Cliver S, Nelson K, Blankson K, Ramey S et al. Pregnancy outcome and intelligence at age five. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A45.

Presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

202 Goldenberg R, Tamura T, Neggers Y, Copper R, Johnson K, DuBard M. et al. Maternal zinc supplementation increases birthweight and head circumference. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A397.

Presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

203 Goldenberg R, Nugent R, Klebanoff M, Krohn M, Hillier S. Vaginal colonization in four ethnic groups. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A151.

Presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

204 Goldenberg RL, Tamura T, Johnston K, DuBard M, Copper R, Neggers Y. Plasma alkaline phosphatase as a predictor of preterm birth. *Am J Obstet Gynecol* 1996;174(1 Pt 2):A583.

Poster presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

205 Goldenberg RL, Tu FF, DuBard M, Tamura T, Zucker SJ, Voss HF. Plasma matrix metalloprotease-9 (MMP-9) levels as predictors of spontaneous preterm birth. *Am J Obstet Gynecol* 1998;178(1 Pt 2):S189.

Poster presentation at the Society of Perinatal Obstetricians 1998 Annual Meeting.

206 Guinn D, Goldenberg R, Cliver S, Hauth J. Preterm birth subsequent to "successful" tocolytic treatment of idiopathic preterm labor. *Am J Obstet Gynecol* 1994;170(Pt 2):A398.

Poster presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

207 Guinn D, Goldenberg R, Cliver S. Which cervical parameter best predicts ultimate preterm birth? *Am J Obstet Gynecol* 1994;170(Pt 2):A399.

Poster presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

208 Guinn DA, Goldenberg RL, Cliver SP, Owen J, Hauth J. Relationship of gestational age and cervical dilation to the success of tocolysis.

Oral presentation at the American College of Obstetricians and Gynecologists. Orlando, FL; May 1994.

209 Guinn DA, Goepfert AR, Owen J, Christine M, Hauth JC. Extraamniotic saline infusion (EASI) was superior to laminaria in a randomized trial of labor induction. *Am J Obstet Gynecol* 1998;178(1 Pt 2):S96.

Poster presentation at the Society of Perinatal Obstetricians 1998 Annual Meeting.

210 Guinn DA, Goepfert AR, Owen J, Wenstrom KD, Hauth JC. Terbutiline pump for prevention of preterm delivery: a double-blind, placebo-controlled trial. *Am J Obstet Gynecol* 1998;178(1 Pt 2):S19.

Oral presentation at the Society of Perinatal Obstetricians 1998 Annual Meeting.

211 Hauth JC, Goldenberg RL, Andrews WW, Copper RL, DuBard MB, Schmid T. The effect of mid-trimester metronidazole plus erythromycin on bacterial vaginosis and other markers of altered vaginal flora. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A152.

Poster presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

212 Hauth JC, Goldenberg RL, Andrews WW, DuBard MB, Copper RL. Mid-trimester treatment with metronidazole plus erythromycin reduces preterm delivery only in women with bacterial vaginosis. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A4.

Oral presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

213 Hauth J, Goldenberg R, Nelson K, DuBard M, Peralta M, Gaudier F. Reduction of cerebral palsy with maternal $MgSO_4$ treatment in newborns weighing 500-1000 g. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A581.

Poster presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

214 Haywood J, Goldenberg RL, Nelson KG, Bronstein J, Carlo WA. Discrepancy between estimated and actual rates of neonatal survival and freedom from handicap. *Pediatric Research* 1993;33(4 Pt 2):A1557.

Presentation at the Society for Pediatric Research meeting.

215 Haywood J, Braune K, Goldenberg RL, Bronstein J, Carlo WA. Pediatricians who underestimate neonatal outcome restrict the utilization of neonatal interventions.

Presentation at the Perinatal Section, American Academy of Pediatrics Annual Meeting. Washington, DC; October 1993.

216 Haywood J, Goldenberg RL, Nelson KG, Bronstein J, Carlo WA. Discrepancy between estimated and actual rates of neonatal survival and freedom from handicap.

Presentation at the Perinatal Section, American Academy of Pediatrics Annual Meeting.

217 Haywood J, Braune K, Goldenberg RL, Bronstein J, Carlo WA. Neonatal outcome: do perceptions affect practice? *Clinical Research* 1993;41(4):A734.

Presentation at the Southern Society for Pediatric Research meeting.

218 Haywood JL, Burnham DE, Goldenberg RL, Nelson KG, Bronstein J, Carlo WA. American pediatricians underestimate survival and freedom from handicap in premature infants. *Pediatric Research* 1994;35(4 Pt 2):A1619.

Presentation at the Society for Pediatric Research meeting.

219 Haywood J, Goldenberg R, Nelson K, Bronstein J, Carlo W. Educational interventions improve misconceptions regarding outcome of VLBW infants. *J Investigative Med* 1995;43(1):A30.

Presentation at the Southern Society for Pediatric Research meeting.

220 Haywood JL, Kizer CC, Goldenberg RL, Nelson KG, Bronstein J, Carlo WA. American obstetricians underestimate outcome potential of premature infants. *Pediatric Research* 1995;37(4 Pt 2):A1539.

Poster presentation at the Society for Pediatric Research meeting.

221 Hickey CA, Cliver SP, McNeal SF, Goldenberg RL, Hoffman HJ. The relationship of employment related risks and preterm delivery.

Poster presentation at the American Public Health Association 121st Annual Meeting. San Francisco, CA; October 1993.

222 Hickey CA, Cliver SP, McNeal SF, Goldenberg RL. Prenatal weight gain patterns and spontaneous preterm birth among nonobese black and white women. *J Am Dietetic Assn* 1994;94(9):A40.

Presentation at the American Dietetic Association 77th Annual Meeting.

223 Hickey CA, Cliver SP, Goldenberg RL, McNeal SF, Hoffman HJ. Relationship of psychosocial status to low maternal weight gain.

Poster presentation at the American Public Health Association. Washington, DC; November 1994.

224 Hickey CA, Cliver SP, Goldenberg RL, McNeal SF, Hoffman HJ. Sociodemographic risk factors for low prenatal weight gain.

Oral presentation at the American Public Health Association. Washington, DC; November 1994.

225 Hickey CA, Cliver SP, Goldenberg RL, McNeal SF, Hoffman HJ. Prenatal weight gain patterns and fetal growth retardation among nonobese black and white women.

Oral presentation at the American Public Health Association 123rd Annual Meeting. San Diego, CA; October 1995.

226 Hickey CA, Cliver SP, McNeal SF, Goldenberg RL. Low prepregnancy body mass index as a risk factor for preterm birth: variation by ethnic group.

Poster presentation at the APHA 124th Annual Meeting New York, NY; November 17-21, 1996.

227 Johnson SE, Lane JB, Steele RA, Cutter GR, Haywood JL, Goldenberg RL, Nelson KG. Do neonatal nurse perceptions influence outcome for extreme preterm infants? *Pediatric Research* 1996;37(4 Pt 2):A219.

228 Johnson SE, Cutter GR, Nelson KG, Klerman LV, Goldenberg RL. Is pessimism about infant survival related to attitudes and behavior of the NICU nurse? *Ambulatory Child Health* 1997;3(1):A321.

Poster presentation at the Ambulatory Pediatric Association 37th Annual Meeting, Washington, DC; May 1997.

229 Kimberlin DF, Hauth JC, Brumfield CG, DuBard M. Maternal obesity: Association with perinatal outcomes. *Am J Obstet Gynecol* 1997;176(1 Pt 2):A643.

Poster presentation at the Society of Perinatal Obstetricians 1997 Annual Meeting

230 Klerman L, Poole J, Phelan. Family planning: its potential for reducing low birthweight.

Poster presentation at the American Public Health Association 122nd Annual Meeting. Washington, DC; October 1994.

231 Klerman LV, Cliver SP, Goldenberg RL. Impact of interpregnancy interval in a low income population.

Poster presentation at the American Public Health Association 123rd Annual Meeting. San Diego, CA; October 1995.

232 Klerman LV, Cliver SP, Goldenberg RL. Impact of short interpregnancy interval in a low income population.

Presentation at the Southern Demographic Association 1995 Annual Meeting. Richmond, VA; October 21, 1995.

233 Klerman LV, Ramey SL, Goldenberg RL, Marbury, S. The UAB Mother and Family Specialty Center: A medical/psychosocial approach to preventing low birthweight.

Poster presentation at the Conference on "The Effectiveness of Prenatal Care: New Evidence, New Paradigms." Harvard June 26-27, 1997; Boston MA.

234 Maher J, Goldenberg R, Cliver S, Davis R, Copper R. Corticosteroid efficacy in very premature infants. *Am J Obstet Gynecol* 1993;168(1 Pt 2):A272.

235 Neggers Y, Goldenberg RL, Cliver SP, Tamura T, Hoffman HJ. Relationship between zinc intake, the intake of other micronutrient and pregnancy outcome.

Poster presentation at the Society for Epidemiologic Research Annual Meeting. June 1994.

236 Nielson E, Hauth JC, Owen J. Perinatal outcome in women with single versus multiple admissions for hyperemesis gravidarum.

Oral presentation at the Society of Perinatal Obstetricians 1994 Annual Meeting. January 1994.

237 Nelson KG, Riley RS, Johnson SE, Steele RA, Ashworth CS, Wall TC. Extremely low birthweight infants: health, growth and achievement in adolescence.

Presentation at the Ambulatory Pediatric Association meeting. Washington, DC; May 6-9, 1996.

238 Ohsfeldt R, Gohmann S. Unintended pregnancy, sample selectivity, and observed birth weight.

Oral presentation at the Allied Social Science Association meeting. Washington, DC; January 1995.

239 Ohsfeldt R, Gohmann S. Unintended pregnancy, sample selection, and birth outcomes.

Presentation at the Western Economic Association meeting. San Diego, CA; July 6, 1995.

240 Owen J, Goldenberg RL, DuBard M, Hsu J. Sonographic fetal weight estimation: the influence of race-specific formulas on predictive accuracy. *Am J Obstet Gynecol* 1996;174(1 Pt 2):A435.

Poster presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

241 Peaceman AM, Andrews WW, Thorp JM, Cliver SP, Lukes A. Fetal fibronectin as a predictor of preterm birth in symptomatic patients — a multicenter trial. *Am J Obstet Gynecol* 1996;174(1 Pt 2):A3.

Oral presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

242 Peralta M, Gaudier F, Goldenberg R, Nelson K, Cliver S. Changes in survival and major neurologic impairment in infants less or equal to 1,000 grams.

Poster presentation at the Society of Pediatric Research Annual Meeting. February 1994.

243 Peralta M, Coston D, Fargason CA. Assessing preferences of pregnant women for two strategies to reduce GBS infection in neonates.

Poster presentation at the Society for Medical Decision Making. Tempe, AZ; October 14, 1995.

244 Peralta M, Fargason Jr. CA, Dolan J, Coston D. Comparing preferences of pregnant women, pediatricians and obstetricians for two strategies to reduce GBS infection in neonates.

Presentation at the Southern Society for Pediatric Research meeting. New Orleans, LA; February 3, 1996.

245 Peralta-Carcelen M, Nelson KG, Riley RS, Johnson SE, Steele RA. Growth of extremely low birth weight adolescents. Preliminary results.

Poster presentation at the General Clinical Research Centers Conference. Arlington, VA; March 1996.

246 Peralta-Carcelen M, Jackson DS, Nelson KG, Royal SA, Yuan A. Growth of extremely low birth weight adolescents. J Investigative Med 1997;45(1):A16.

Presentation at the American Federation for Clinical Research Regional Meeting. New Orleans, LA; February 1997.

247 Peralta-Carcelen M, Nelson KG, Hodgens B. Cognitive and behavioral outcome of extreme low birth weight adolescents. *Ambulatory Child Health* 1997;3(1):A323.

Poster presentation at the Ambulatory Pediatric Association 37th Annual Meeting, Washington, DC; May 1997.

248 Peralta-Carcelen M, Jackson DS, Nelson KG, Royal SA. Growth of extremely low birth weight adolescents. *Ambulatory Child Health* 1997;3(1):A324.

Poster presentation at the Ambulatory Pediatric Association 37th Annual Meeting, Washington, DC; May 1997.

249 Phibbs CS, Bronstein JM, Buxton E, Phibbs RH. The effects of patient volume and level of care on neonatal mortality: is competition killing babies? *J Investigative Med* 1996;A96.

Oral presentation at the Western Society for Pediatric Research meeting.

250 Phibbs CS, Bronstein JM, Buxton E, Phibbs RH. The effects of patient volume and level of care at the hospital of birth on neonatal mortality: is competition killing babies? *Pediatric Research* 1996;39(4 Pt 2):A1413.

Presentation at the Society for Pediatric Research Annual Meeting.

251 Phibbs CS, Bronstein JM, Buxton E, Phibbs RH. The effects of patient volume and level of care at the hospital of birth on neonatal mortality: is competition killing babies?

Presentation at the Association for Health Services Research 13th Annual Meeting. Atlanta, GA; June 9, 1996.

252 Phibbs CS, Bronstein JM, Buxton E, Phibbs RH. NICU patient volume and level of care. *Am J Managed Care* 1997;3(2):192.

253 Phibbs CS, Baker LC, Wheeler SK, Phibbs RH. Can we explain the differences in neonatal mortality between patients insured by health maintenance organizations and patients insured by other private insurance in California? *Journal of Investigative Medicine* 1998;46:158A.

Presentation at the Western Society for Pediatric Research Annual Meeting, Carmel, CA; February 7, 1998.

254 Piper J, Atkinson M, Mitchell E, Cliver S, Snowden M, Wilson S et al. Improved outcomes for very low birth weight infants associated with combination maternal corticosteroids and tocolytics. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A571.

255 Poole VL, Klerman LV, Goldenberg RL, Cliver SP. Pregnancy intendedness and maternal behaviors in a low-income high risk population.

Presentation at the Southern Demographic Association meeting. October 22, 1994.

256 Ramey SL, Klerman LV. Mother and family specialty center.

Poster presentation at the Conference on the Effectiveness of Prenatal Care: New Evidence, New Paradigms. Harvard; June 1997.

257 Rouse D, Goldenberg R, Cliver S, Cutter G, Mennemeyer S, Fargason C. Strategies for the prevention of early onset neonatal group B streptococcal sepsis: a decision analysis. *Am J Obstet Gynecol* 1994;170(1 Pt 2):A42.

Oral presentation at the Society of Perinatal Obstetricians 14th Annual Meeting. Las Vegas, NV; 1994.

258 Rouse DJ, Owen J, Goldenberg RL, Vermund SH. Zidovudine for the prevention of vertical HIV transmission: a decision analytic approach. *J Acquired Immune Deficiency Syndromes* 1995;172(1 Pt 2):A171.

Presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

259 Rouse DJ, Gardner M, Allen S. Varicella-zoster immune globulin (VZIG) for the at-risk gravida? A decision analysis. *Am J Obstet Gynecol* 1996;174(1 Pt 2):A363.

Poster presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

260 Rouse DJ, Hauth JC, Andrews WW, Mills BB, Maher JE. Chlorhexidine vaginal irrigation to prevent puerperal infection. *Am J Obstet Gynecol* 1997;176(1 Pt 2):A172.

Poster presentation at the Society of Perinatal Obstetricians 1997 Annual Meeting.

261 Rouse DJ, Owen J, DuBard M. Is male gender a risk factor for Cesarean delivery? *Am J Obstet Gynecol* 1998;178(1 Pt 2):S77.

Poster presentation at the Society of Perinatal Obstetricians 1998 Annual Meeting.

262 Rouse DJ, Owen J, Hauth JC. Active phase labor arrest: two hours of oxytocin augmentation is not enough. *Am J Obstet Gynecol* 1998;178(1 Pt 2):S3.

Oral presentation at the Society of Perinatal Obstetricians 1998 Annual Meeting.

263 Rouse DJ, Loncar JM, Owen J, Hauth JC, DuBared M. Does intrapartum epidural analgesia increase the Cesaren delivery rate? *Am J Obstet Gynecol* 1998;178(1 Pt 2):S175.

Poster presentation at the Society of Perinatal Obstetricians 1998 Annual Meeting.

264 Tamura T, Goldenberg RL, Johnston K, Cliver SP. The association between increased plasma ferritin concentration and preterm delivery. *Am J Clin Nutr* 1995;61:A114.

Presentation at the American Society for Clinical Nutrition meeting.

265 Wenstrom KD, Owen J, Boots L, DuBard MB. Is elevated second trimester hCG associated with poor pregnancy outcome? *Am J Obstet Gynecol* 1994;170(Pt 2):A271.

Presentation at the Society of Perinatal Obstetricians 14th Annual Meeting.

266 Wenstrom KD, Hauth JC, Goldenberg RL, DuBard MB, Lea C. The effect of low-dose aspirin on the development of preeclampsia in women with elevated hCG. *Am J Obstet Gynecol* 1995;172(1 Pt 2):A421.

Poster presentation at the Society of Perinatal Obstetricians 15th Annual Meeting.

267 Wenstrom KD, Andrews WW, Tamura T, DuBard M, Johnston KE, Hemstreet GP. Elevated amniotic fluid interleukin-6 levels at genetic amniocentesis predict subsequent pregnancy loss. *Am J Obstet Gynecol* 1996;174(1 Pt 2):A25.

Oral presentation at the Society of Perinatal Obstetricians 1996 Annual Meeting.

268 Wenstrom KD, Miller M, Brumfield C, Davis R, Owen J. Amniotic fluid pulmonary maturity studies may be unnecessary in fetuses with meningomyelocele and hydrocephalus. *Am J Obstet Gynecol* 1996;174.

Presentation at the Society of Perinatal Obstetricians 1997 Annual Meeting.

269 Wenstrom KD, Andrews WW, Bowles N, Towbin JA, Hauth JC, Goldenberg RL. Intrauterine viral infection at the time of second trimester genetic amniocentesis is not associated with post-procedure loss.

Presentation at the Society for Gynecologic Investigation meeting. San Diego, CA; March 1997.

270 Wenstrom KD, Bajai PK, DuBard M, Cliver S. Is sonographic EFW less accurate in breech presentation? *Am J Obstet Gynecol* 1998;178(1 Pt 2): S167.

Poster presentation at the Society for Perinatal Obstetricians 1998 Annual Meeting.

271 Wenstrom KD, Biggio JR, DuBard M. Does hydramnios indicate adverse perinatal outcome? *Am J Obstet Gynecol* 1998;178(1 Pt 2):S170.

Presentation at the Society for Perinatal Obstetricians 1998 Annual Meeting.

Invited Presentations:

272 Goldenberg RL. Use of antenatal steroids in special circumstances and populations: introduction and definition of the problem.

Presentation at the NIH Consensus Development Conference, Effect of Corticosteroids for Fetal Maturation on Perinatal Outcomes. Washington, DC; February 28-March 2, 1994.

273 Goldenberg RL, Cliver SP, Hickey CA, Andrews W. Examination of the relationship of psychosocial and physiologic factors to preterm delivery using existing datasets.

Seminar at the Centers for Disease Control. Atlanta, GA; April 1994.

274 Goldenberg RL, Cliver SP, Hickey CA, Klerman LV. Examination of the relationship of psychosocial and physiologic factors to preterm delivery using existing datasets.

Workshop on Preterm Delivery and Other Pregnancy Outcomes Among Black Women. Atlanta, GA; May 19, 1995.

275 Goldenberg RL. Antenatal steroid administration.

Grand Rounds at Hospital of St. Raphael, New Haven, CT; January 23, 1996.

276 Goldenberg RL. Invited Presentations: Infection and preterm delivery; and. Strategies to improve outcome related to preterm birth.

Midwinter Seminar in Obstetrics and Gynecology, University of South Florida, St. Petersburg, FL; February 29, 1996.

277 Goldenberg RL. Invited Presentations: An evaluation of strategies to improve low birthweight outcome; and Outcome of Preterm births.

Twenty-first Annual Update in Obstetrics and gynecology, Lake Buena Vista FL; March 13, 1996.

278 Goldenberg RL. An evaluation of strategies to reduce low birthweight.

Grand Rounds, Rochester General Hospital, Rochester, NY; March 20, 1996.

279 Goldenberg RL. Infection and preterm birth.

12 Annual W. Newton Long Lecture, Emory University School of Medicine; March 27, 1996.

280 Goldenberg RL. Invited Presentations: Preterm birth prevention: Does anything work? and Pregnancy outcome and intelligence at age five.

Lagacy Portland Hospital, Portland OR; May 3, 1996.

281 Goldenberg RL. Invited Presentations: An evaluation of strategies to reduce low birthweight; and Infections and preterm birth.

Lonnie Burnett Vanderbilt Ob/Gyn Society, Jacksonville, FL; June 6-7, 1996.

282 Goldenberg RL. An evaluation of strategies to reduce low birthweight deliveries.

University of Michigan, Ann Arbor, MI; June 19-20, 1996.

283 Goldenberg RL. Black/white differences in pregnancy outcome.

Minority Medical Education Program: Health Care Issues-Women's Health, University of Alabama at Birmingham; July 10, 1996.

284 Goldenberg RL. Infection and preterm labor.

University of Florida-Update in Ob/Gyn, San Destin, FL; August 24, 1996.

285 Goldenberg RL. Invited Presentations: Preterm labor prevention: the BV connection; and, Strategies to improve outcomes in low birthweight newborns.

Ambulatory Ob/Gyn Nursing 11th Annual Conference, Washington, DC; October 12, 1996.

286 Goldenberg RL. Invited Presentations: Prediction of prematurity; and Local vaginal pathogens and prematuirty.

World Congress in Perinatal Medicine, San Francisco, CA; October 22, 1996.

287 Goldenberg RL. An evaluation of strategies used to improve outcomes associated with low birthweight.

Medical University of South Carolina-1996 Annual Conference of the National Perinatal Association, Nashville, TN; November 7, 1996.

288 Goldenberg RL. Controversies in prematurity.

Invited presentation at the Society of Perinatal Obstetricians; January 21, 1997.

289 Goldenberg RL. Impact of sexually transmitted disease on pregnancy outcome.

Annual Obstetrics and Gynecology Progress Meeting, Birmingham, AL, February 6, 1997.

290 Goldenberg RL. Invited Presentations: Screening for risk of preterm delivery: bacterial vaginosis, cervical ultrasound and fetal fibronectin; Evaluation of strategies aimed at reducing preterm birth; Do antenatal cortisosteroids improve perinatal outcome; Should we do antepartum screening for group B Streptococcus?

American College of Obstetricians and Gynecologists Meeting, Beth Israel Health Care Clinical Obstetrician in the Era of Managed Care: Role of Cost-effective and Evidence-based Obstetric Practice, Puerto Rico; February 10-12, 1997.

291 Goldenberg RL. Invited Presentations: Risk factors for preterm labor; and, Understanding the relationship between infection and preterm birth.

Contemporary Forums Health Start/Preterm Delivery Prevention Program, Oakland, CA; April 4, 1997.

292 Goldenberg RL. Invited Presentations: Screening for low birth weight risk; An evaluation of strategies for improving the outcomes of low birthweight deliveries; The use of steroids in the imminent preterm delivery.

National Federation of Perinatal Medicine, Sponsored by the Ministry of Health and the University of Valley, Cali, Columbia; April 23-26, 1997.

293 Goldenberg RL. Low Birthweight PORT: Antenatal Corticosteroid Dissemination Study.

Invited presentation for the AHCPR Pharmaceutical Outcomes Research Group, Rockville, MD; May 22, 1997.

294 Goldenberg RL. Infection and adverse pregnancy outcomes.

Grand Rounds at Tulane University, New Orleans, LA; May 22, 1997

295 Goldenberg RL. Interventions to Prevent Prematurity.

Invited presentation to the AHCPR-supported Conference on "The Effectiveness of Prenatal Care: New Evidence, New Paradigms." Harvard; Boston, MA; June 26-27, 1997.

296 Goldenberg RL. Infection and preterm birth.

Grand Rounds at Medical Center of Central Georgia, Macon, GA; October 8, 1997.

297 Goldenberg RL. Prevention of Preterm Delivery.

Invited presentation to a national invitational conference on "Preterm Birth: Etiology, Mechanisms, and Prevention." Charleston, SC; October 26-28, 1997.

298 Goldenberg RL. Strategies for preterm labor prevention.

Invited presentation to the New England Ob/Gyn Society, Boston, MA; October 29.

299 Goldenberg RL. Low Birthweight PORT. "Selected Accomplishments: A Historical Perspective."

Invited presentation at an AHCPR-sponsored Conference, "Outcomes Research: Engine for Quality Improvement," Washington, DC; October 30-31, 1997.

300 Goldenberg RL. Preventing preterm birth: progress and problems.

Invited presentation at "Innovations in Perinatal Care: Assessing Benefits and Risks, 12th *Birth* Conference, sponsored by *Birth* and the Boston University School of Public Health, Boston, MA; June 5-7, 1998.

301 Klerman L. The potential impact of family planning on low birthweight: the PORT approach.

Presentation to the Department of Obstetrics and Gynecology. Los Angeles, CA; August 1993.

302 Klerman L. The PORT approach to low birthweight.

Presentation to the Reproductive Health Branch, Centers for Disease Control; June 1994.

303 Klerman LV. Unintended pregnancies—impact on individual, family and community security. A regional perspective.

Presentation at a conference convened by Region IV of the PHS and the US Department of Education; September, 1995.

304 Klerman LV. Pre- and interception care: their role in improving the health of women and children.

Presentation at the Eighth Annual Thomas A. Leonard M.D. Memorial Lecture at a Plenary Session of the Statewide Perinatal Conference, 26th Annual Meeting of the Wisconsin Association for Perinatal Care. Wisconsin; April 20, 1996.

305 Klerman LV. Pregnancy intendedness: Is it a useful concept?

Presentation at the RAND seminar. Santa Monica, CA; June 1996

306 Klerman LV. The issue of unintended pregnancy in the US and Alabama.

Presentation at the Conference on Increasing Contraceptive Compliance. Auburn University, Montgomery, AL; September 1996.

307 Klerman LV. Unintended pregnancy.

Presentation at a colloquium, University of Alabama School of Social Work. Tuscaloosa, AL; January 1997.

308 Klerman LV. Interconception care and opportunities for family planning.

Invited presentation to the Conference on "The Effectiveness of Prenatal Care: New Evidence, New Paradigms." Harvard; Boston MA; June 26-27, 1997.

309 Klerman LV. What is the meaning of intention status?

Invited presentation at Maternal, Infant, and Child Health Epidemiology Workshop, sponsored by the CDC and other agencies. Atlanta, GA; December 10, 1997.

310 Klerman LV. Unintended pregnancy: is it a useful concept?

Presentation at the School of Public Health, University of North Carolina, Chapel Hill, NC; January 1998.

311 Maher J, Goldenberg RL, Cliver SP, Davis RO, Copper RL. The effect of corticosteroid therapy in the very premature infant.

Presentation at the NIH Consensus Development Conference, Effect of Corticosteroids for Fetal Maturation on Perinatal Outcomes. Washington, DC; February 28-March 2, 1994.

312 Merkatz IR, Atkinson MW. What is the evidence for the effectiveness of maternal combination therapy?

Presentation at the NIH Consensus Development Conference, Effect of Corticosteroids for Fetal Maturation on Perinatal Outcomes. Washington, DC; February 28-March 2, 1994.

313 Nelson KG. Short and long-term outcomes of IUGR.

Invited presentation to the Conference on "The Effectiveness of Prenatal Care: New Evidence, New Paradigms." Harvard; Boston MA; June 26-27, 1997.

314 Ohsfeldt RL, Antel JJ, Gohmann SF. Unintended pregnancies, sample selection, and birth outcomes.

Invited lecture presentation to Project HOPE. Bethesda, MD; December 1997.

315 Rouse DJ. Prevention of early onset neonatal group B streptococcal disease.

Invited presentation to the infectious disease special interest group. Society of Perinatal Obstetricians, Atlanta, GA; January 1995.

PORT Findings in the Media and Popular Press

Published in National Media and Widely Disseminated Non-Academic Publications:

316 Premie research watched. *The Bremerton Sun*. November 7, 1992.

317 Do adolescent mothers have better outcomes the second time around? UAB's *Lister Hill Center for Health Policy*. 1993;3(7):1.

318 Have we underestimated the cost of low birthweight babies due to maternal smoking? UAB's *Lister Hill Center for Health Policy*. 1994;4(8):1.

319 Is it cost effective to treat pregnancy conditions with bed rest? UAB's *Lister Hill Center for Health Policy*. 1994;4(11):1.

320 Can decision analysis techniques improve physician choices for newborns? UAB's *Lister Hill Center for Health Policy*. 1994;5(2):1.

321 Routine iron supplementation during pregnancy. *Abstracts of Clinical Care Guidelines*. 1994;6(2):15-18.

322 Comparing options of managing GBS intrapartum. *ACOG Newsletter*. May 1994;38(5):8.

323 Experts say tocolysis is overused, but ob-gyns are too slow to prescribe corticosteroids. *Medical Tribune*. June 2, 1994;1(9).1.

324 Bed rest in pregnancy shows little evidence of helping, study finds. *New York*. July 13, 1994.

325 Better birth weights. *Time Magazine*. 1995.

326 Benefits of antenatal corticosteroids said to far outweigh potential risks. *ACM News*. June 19, 1995:9.

327 Erythromycin shows no benefit in group B strep in pregnancy. *Medical Tribune*. July 13, 1995:16.

328 Does prenatal care reduce low birth weight births? *Lister Hill Center for Health Policy: UAB Health Policy Research* 1995;6(1):1.

329 Low birth weight patient outcomes research team (LBW PORT) enters fourth successful year. *Lister Hill Center for Health Policy: UAB Health Policy Research* February 1996:3.

330 Are potentially effective therapies being under utilized because of physician practice patterns? *Lister Hill Center for Health Policy: UAB Health Policy Research* 1996;6(6):1.

331 Low birthweight PORT examines use of prenatal testing and corticosteroids in prevention of preterm birth. *AHCPR Research Activities*. 1996;192:6-7.

332 Sophisticated neonatal ICUs save lives, money, study says. Faulkner & Gray's *Medicine & Health*. 1996;50(39):2.

333 Can we decrease newborn mortality without increasing costs? *Lister Hill Center for Health Policy: UAB Health Policy Research* 1996;7(1):1.

334 Bed rest dilemma. Julia Porter – like thousands of women – was sent to bed to safeguard her pregnancy. Was it necessary? *The Washington Post*. January 14, 1997:Z12.

335 Bacterial vaginosis and its link to preterm birth. Healthy Mothers, Healthy Babies' *Power News*. Winter 1997;3(1).

336 Health plan promotes better outcomes: Corticosteroid program uses education, praise. *American Health Consultants*. March 1997;3(3):33-35.

337 Goldenberg RL. *Managing preterm labor: Expert exchange*. In: OBG Management, June 1997.

338 Do Nonclinical Factors Influence Practice Variation? *Lister Hill Center for Health Policy: UAB Health Policy Research* 1998;8(3):1.

Published in Local Media:

339 UAB gets $4.8 million grant to help stop prematurity in minority babies. *Birmingham Post-Herald*. October 27, 1992:B4.

340 Alabama children live riskier lives than most. *Birmingham News*. March 29, 1993:1.

341 Community leaders seek solution to teen pregnancy. *Birmingham News*. May 4, 1995.

342 Another look at unplanned pregnancy. UAB's *Synopsis*. 1995;14(23):3.

343 Antenatal corticosteroids cut morbidity and mortality of premature births. *UAB Insight*. Fall 1995.

344 Zinc helps moms have bigger, smarter babies. *Birmingham News*. August 9, 1995:1.

345 Birth rate for premies in Alabama triples. *Birmingham News*. September 20, 1995:B2.

346 UAB researchers cast doubt on vitamin value in pregnancy. *Birmingham News*. April 10, 1996.

347 Periodontal disease linked to premature births. UAB's *Synopsis*. 1996;15(43):1.

[illegible] Sandberg SL. Managing growth: [illegible] Report [illegible] OHD Management, June 1997.

[illegible] [illegible] Factors Influence Prenatal [illegible] 1997 [illegible] Health Policy [illegible] Health Policy Research 1995;3(10).

Publications in Local Media

[illegible] [illegible] Birmingham Post-Herald [illegible]

[illegible] [illegible] than ever. Birmingham News, March 28, 1993.

[illegible] [illegible] schools to [illegible] pregnancy. Birmingham News, May 6, 1993.

[illegible] [illegible] UAB's Reporter, 1993;17(20):3.

[illegible] [illegible] availability and quality of prenatal care. UAB Reporter, [illegible]

[illegible] [illegible] Birmingham News, August [illegible], 1993.

[illegible] [illegible] Birmingham News, September [illegible], 1993.

[illegible] [illegible] pregnancy. Birmingham News, March 10, 1994.

[illegible] [illegible] within UAB's Reporter, 1994;[illegible]

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